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THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. WASHINGTON, D. C.

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington, D. C.

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WHEN THE CALL TO THE "OPEN ROAD" IS STRONGEST.

Better Crops with PLANT FOOD

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You can't get away from—

Shares Well Scoured

Jeff McDermid

RETIRED farmers, known of old as "resigned" farmers, have become obsolete in my countryside. To use a modern term that denotes them more explicitly in this age of continual motion, the elder farmers are "re-tired" farmers. They cushion the calluses of time with a new "tread" and so roll on over their last mileage almost as good as new. Consequently no moss collects and age doth not corrode.

In my journeys through loamy settlements I find it well not to submit the question of retirement too bluntly. For no longer does the veteran of countless harvests habituate himself by carriage and deportment to any imminent autumnal relaxation. The farmer of the present is not the bewhiskered ancient relic, clad outlandishly, whose bent figure was so much a part of Main Street on Saturdays when we were young.

Thus to begin with, the personality and demeanor of a more youthful era have laid hold on the American scene so as to eradicate some of those signs and symptoms that caused folks to grow old and weary just by living and looking that way.

Now this is no challenge to social debate or psychological analysis. I merely record my direct and frequent observation that the smooth-faced, clean-jawed fashion of our times, plus easy access to reasonably fitting garments, has added years to the expectancy of farmers—and their wives prob-

ably use modish patterns, cosmetics, and nail varnish with the same happy consequence.

While it is not quite true that one is only as old as he looks, let us bring our own childhood impressions in to prove our thesis. We can all remember how the pictures of the statesmen and generals of the conflict in the Sixties made us youngsters think they resembled the patriarchs of the Bible, and how Uncle Bildad looked in that old wet-plate negative, with matted locks and ferocious sideburns.

Those forests of hirsute vigor which no conservation laws regulated, either in the growing or the trimming, merely disfigured and disguised the curving mouths and firm cheeks of youth gone to grass and choked with weeds. When informed that those bushy braves were only in their middle thirties or even younger when fame made them immortal, you ceased to wonder why they often died so young. Old tales of hardship as a shortener of careers were discounted in favor of tangled whiskers. You saw that he who courts old age is not long in winning her.

AND naturally a woman who lives with a man who doesn't want to stay young is apt to become a dowdy dowager before the kids are grown. She was old at thirty by partnership. Moreover, the weight of such whiskers and their tendency to snarl into his work was enough to stoop the farmer's shoulders even after the invention of the reaper. (On the side, I often wonder if McCormick or Gillette furnished the more helpful clipper in the long run.)

Perhaps it took three or four generations of retiring farmers to prove to the younger ones that he who quits work and sinks into somnolence is tempting forces of decay to consume him quickly. Thus men spoke feelingly of "wearing out" and "rusting out" and pointed to retired gentlemen of their acquaintance as evidence enough.

Of course, in reasoning out this doctrine we are obliged to consider the broad differences between small country hamlets now and back yonder. In the heyday of popular farm retirement (before the "California migration") our elder agronomists leased or sold the homestead and moved into the nearest trading post, where they were able to mingle for awhile in town society. They could forget the "cock-crow" of early rising, but they never got over listening hard for the dinner bell.

Undoubtedly he who luxuriates in leisure whilst taking on weight at the accustomed gravy hour is fixing up for himself a nice dose of what the horse doctors call "azoturia." That is the malady of hard-working old plugs which are laid off for a spell on normal rations.

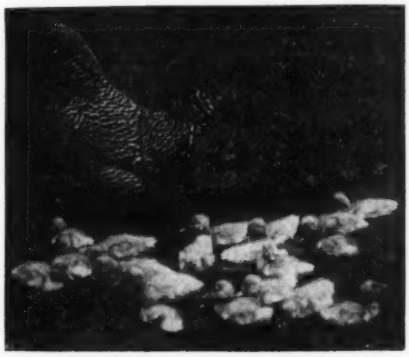
WHERE these complacent retired farmers fitted into a village pattern without reducing their caloric intake of molasses, pancakes, and pork chops, it made a fine market for patent medicine vendors and coffin factories. Minus the early rising fixed by the rooster at dawn with the chores to perform, the retired farmer was obliged to imbibe Doc Slug's "Early Riser" pills for different but important reasons.

There were a minority of retired haymakers who regarded Pasadena as the seventh heaven of the gods. Mount Olympus was a tame affair compared to retiring thither, and it was also noted for its grape juice. All their lives they had read fancy brochures and tourist prospectuses relating the salubrious climatic advantages of the Golden Coast compared to a frigid life on one side and a frying spell on the other, such as Nebraska or Iowa usually furnished its denizens. Then besides it would be so nice indeed to live out there where the bathing gals disported and the movies were made, and send home orange blossom post cards to Uncle Zeke for him to think about while thawing out the pump.

But we must dismiss those lucky gentry as not being within the scope of this excellent treatise. We must stick to the home-staters. Besides,

I expect that California supplied so much vitamin tonic with every gulp and every breath that my arguments herein won't hold water "west of the Pecos." In fact, I never heard of the demise of a single emigrant to that fair land of lure.

Returning to Pa and Ma who have retired to town, it was usually Ma who



lived the longer because she kept so busy. She did housework or gardening or else took in kids to mind, or did kitchen duty for the ladies' aid during church socials. When that wasn't enough she used up all of Pa's old overalls for hooked rugs. Poor Pa slunk around and whittled a little, and looked a lot up and down the road and at the sky frequently—a farmer seldom ever gets over looking at the sky, you know. He had personal bothers like bilious attacks and gout, and his eyes troubled him so he didn't care a hoot about the motion picture shows or even the leg shows on Main Street in March. He caught a ride out to the old farm sometimes and tried his hand at pitching or bossing maybe, but it never set well with the renters and he got tired of that in a hurry. So Pa was left flat on his retirement and no mistake.

In this connection, we admit that the backgrounds of lives spent in small towns have faced a change. With that shift in scenery comes less desire and opportunity for loafing. Hence, the elder farmers when thinking of retiring to occupy a niche among the worthies of some bucolic retreat are obliged nowadays to realize that loafing around town is not as much fun as loafing right out on the homestead.

Idleness and loafing to kill what little time there was left used to be a cause of quick decline on the part of our retired plowmen. And why not? The whole atmosphere of our old-time country towns was ideal for idlers. Let's see to what extent my thesis is true, and what's happened meanwhile.

Begin with the "pustoffus," where the folks met to chin together while the postmaster finished reading all the cards and threw open the wicket with a bang to hand out the daily receipts. Here you got all manner of social and personal news tidbits and met political friends and "your country's enemies." But most sizable towns nowadays have postmen to sort and carry out the mail, so there is little excuse to hang around Uncle Sam's domain any longer.

Next perhaps, one went to the corner grocery which was always a haven for the retired farmers, who sat on well-polished benches and commented on sundry events while nibbling prunes and crackers. Indeed this spot was the informal lyceum and forum of the day, the place where reputations were rent asunder under the frank criticism of experts, and where free speech often proved pretty expensive. Yet even this sacred place has undergone a remarkable transformation. It's no refuge for overladen gossips any longer. You enter by a gate, take a basket, and do your own shoplifting; have your change ready at the exit and make it snappy! You won't find any benches or chairs either, for not even the clerks may sit down.

IF you speed in desperation to the blacksmith shop in hopes of finding old cronies there, it's just too bad because there isn't any anvil chorus in the whole burg. Your next best bet is the garage or filling station, and that's too smelly and greasy for breathing or squatting. Of course, you can hang around awhile and let them fill your

(*Turn to page* 47)

Available Potassium in Alabama Soils

By N. J. Volk

Alabama Agricultural Experiment Station, Auburn, Alabama

IT has been said that man in 100 years of farming has about destroyed what it took nature several thousand years to build into our soils. This is undoubtedly true in a great many cases if considered from the standpoint of the destruction of organic matter and the loss of soil through erosion. But in the case of Alabama, let's not blame it all on the farmer—weathering forces had done a pretty good job of wearing out Alabama's soils before they were turned over to modern man.

In the first place, the majority of the soil materials of the State were juggled about severely before being allowed to come to rest in the positions they now hold. For example, weathering agencies tore down the Piedmont Mountains and dumped them into the sea; geological forces raised this material up out of the sea and made the Appalachian Mountains, which were in turn torn down and dumped back into the sea. Later on, after a series of such immersions into the sea, the soil materials of Alabama were raised above water for the last time. In moving these soil materials from place to place and thoroughly washing them with sea water, the forces of nature dissolved great quantities of potassium from the original minerals. This potassium found its way into the sea and is lost to the present soils of Alabama forever.

Not satisfied with the havoc played

When peanuts are harvested, large amounts of potash are removed from the soil and following crops suffer unless this potash is replaced.

by using Alabama's soil materials like a football for a few million years, the forces of nature set up a climate, warm and humid, in Alabama. Weathering agencies, such as hydration, oxidation, reduction, carbonation, solution, and leaching, worked overtime, winter and summer, and at top speed in their attempt to remove the remainder of the potash from the soil. In the northern part of the Temperate Zone weathering processes go on at a much slower rate.

A good example of how thoroughly Alabama soils have been depleted of their potash is presented in Table 1. Note that the best soils of Alabama contain only about as much total potassium as the poorest sands in Wisconsin —the latter soils were chosen for comparative purposes as they are young glacial soils which have not been weathered nearly so severely as southeastern soils. So, let's not blame all our troubles on what man has done. He started with an inferior soil in many cases, a soil robbed of one of its valuable partially frozen assets—total potassium. But man can overcome this lack of native potassium by the judicious use of commercial potassium and good cultural practices.

For the past 25 years or so, agricultural workers have considered that a knowledge of the amount of total potassium contained in a soil was of little or no value. Nevertheless, the amount of total potassium in a soil and the kind of minerals in which it exists are of

TABLE 1. THE TOTAL POTASSIUM CONTAINED IN ALABAMA SOILS (OLD GEOLOGICALLY) AND WISCONSIN SOILS (YOUNG GEOLOGICALLY)

Soil type	State	Number of samples analyzed	Average pounds of total potassium per acre 6⅔-inch depth
Tifton sandy loam	Alabama	1	1,182
Orangeburg sandy loam	"	1	1,454
Colbert fine sandy loam	"	1	3,818
Cecil clay	"	1	5,545
Clarksville sandy clay loam	"	1	6,181
Savannah very fine sandy loam	"	1	6,545
Hartsells fine sandy loam	"	1	6,636
Durham fine sandy loam	"	1	7,090
Decatur clay	"	1	10,817
Davidson clay loam	"	1	12,817
Vilas sand	Wisconsin*	6	9,200
Dunning sand	"	1	9,400
Clyde fine sand	"	2	11,000
Miami fine sand	"	3	13,100
Boone fine sand	"	11	16,200
Clyde fine sandy loam	"	2	19,600
Plainfield sand	"	39	22,000
Vilas fine sand	"	1	24,400
Vilas sandy loam	"	7	25,600
Miami sandy loam	"	1	29,000
Colby silt loam	"	5	31,400
Knox silt loam	"	11	35,000
Miami silt loam	"	13	43,200
Clyde silty clay loam	"	4	43,800
Boone loam	"	4	49,400
Superior clay	"	10	51,000

* Wisconsin Geological and Natural History Survey, Bulletin No. 68, A. R. Whitson, University of Wisconsin.

extreme importance in enabling the soil scientist to predict the ability of a given soil to rebuild its replaceable potash content following the removal of potash by a crop. Soils differ greatly in this respect. Seriously depleting an average Alabama soil of its replaceable potash by one, two, three, or more successive tion in the soil types of Alabama. These soils were placed in two-gallon jars, fertilized well for each crop with everything but potash. Four crops were grown on them in one year; namely, soybeans, vetch, peanuts, and cotton. Several of the soils are now growing

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TABLE 2. THE ABILITY OF SOILS TO REBUILD REPLACEABLE POTASSIUM AFTER A COTTON CROP IS REMOVED

Date of sampling soil	Pounds per acre of replaceable potassium found in the soil in 64 fields in Alabama*
August 26, 1937	183
October 29, 1937 (day following a frost which stopped the growth of the cotton)	187
March 12, 1938	235

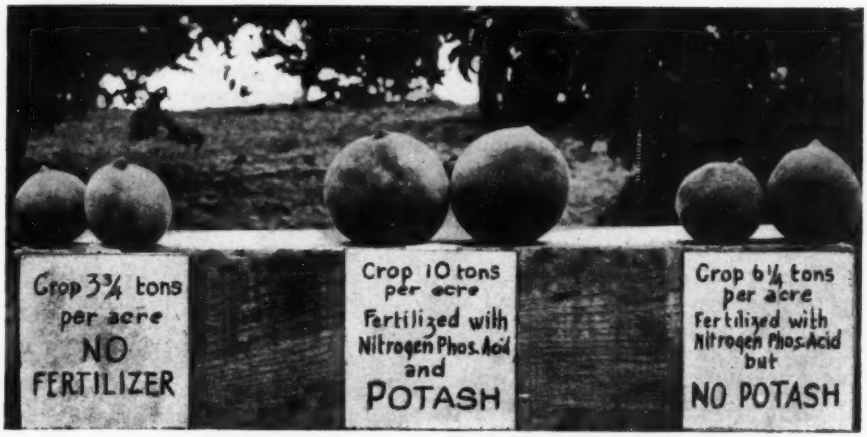
* Samples of soil were composites of 20 borings 8 inches deep taken from about a 1/40-acre area in each field. The same 1/40-acre was used for all three samplings.

crops is a comparatively easy matter, but not so with the younger types of soils in other regions. The difference is due very largely to the fact that the agencies of weathering left a very low reserve of total potassium in Alabama soils. On an average, they left about 1/10 to 1/5 as much as is found in the young Wisconsin soils. Even so, Alabama soils are able to rebuild their supply of replaceable potassium to some extent through the release of potassium from non-replaceable forms.

During a study of cotton rust, the occasion presented itself for sampling 64 cotton fields in Alabama and analyzing the soils for replaceable potash. These fields were sampled on August 26 and October 29, 1937, and on March 12, 1938. The results, presented in Table 2, clearly reveal that these soils did rebuild replaceable potassium during the winter months to the extent of about 50 pounds per acre.

Further evidence supporting the fact that even the highly weathered soils of Alabama can supply some potash from so-called non-replaceable forms is given in Table 3. In this study, 10 soils were selected which represented a wide varia-

Winter legumes, such as vetch, make good cover crops to conserve soil potash by preventing leaching. These crops also use large amounts of potash and if removed make a heavy drain on the soil's supply.


Crop 3¾ tons per acre
NO FERTILIZER
Crop 10 tons per acre
Fertilized with Nitrogen Phos. Acid and
POTASH
Crop 6¼ tons per acre
Fertilized with Nitrogen Phos. Acid but
NO POTASH

Comparative sizes of fruit from an experiment on fertilizing peaches near Penryn, California, in 1908.

Some Early Experiences With Fertilizer on the Pacific Coast

By B. E. Maynard

San Jose, California

¶ *Second of a series of articles recounting personal experiences with the use of fertilizer on the Pacific Coast during the past fifty years.*

IN a previous article I told of results obtained from potash used as a fertilizer on prune trees growing in a deep alluvial soil. Results obtained on a soil apparently of a glacial formation, composed largely of disintegrated rock mixed with boulders, gravel, sand and soil of a loamy type, were equally favorable. This particular piece of land—about 35 acres—was planted to French prunes, plums, silver prunes, apricots, pears, and peaches, all practically in full bearing. Production was moderate, and fruit fair in quality. However, there was plenty of evidence that the condition and welfare of the trees could be improved by judicious fertilization.

Owing to the idea, prevalent even in the early nineties, that nitrogen was the only fertilizer element needed in California soils, about eight acres of full-bearing apricot trees were given an application of nitrate of soda in April, which application was followed by sufficient rainfall to carry it down to the feeding rootlets. The trees responded well following this treatment, as shown by the healthy appearance of the foliage and vigorous growth of new wood, which continued growing right into November. The large crop of fruit set had to be heavily thinned.

The fruit sized up well, but ripening was greatly retarded. Normally picking should have been well under way

about the fourth of July, but in this case was not commenced until the first of August. The fruit, however, when ripe, was soft and tasteless, and shrinkage in drying was abnormally heavy. The green fruit was found to mush badly when handled by the cutters. Many of the pieces when dry were so misshapened and flattened out that they were classed as slabs, and brought a much lower price. The pieces that retained their shape were thin instead of being thick and meaty. This falling off in the quality of the fruit indicated that nitrogen used alone impaired quality and retarded ripening, although tree growth was increased and the size of the fresh fruit was not impaired.

In the following years, to better insure quality and favor earlier ripening, a 3-8-10 fertilizer was applied to these trees at the rate of about 1,000 pounds per acre. Under this treatment the trees increased production, and the quality of the fruit was greatly improved. The vigor of trees was also fully maintained. Bur clover growing among these trees responded by forming a heavy mat of humus-making material to be plowed under, as well as to increase the soil content of nitrogen.

If anything, peaches responded better to applications of this 3-8-10 than did the apricots. About 50 peach trees, Crawfords, Fosters, and Susquehannas (all freestones), adjoining the apricots were given the same application of the 3-8-10, but had not received the former application of nitrogen alone. The response from the 3-8-10 on these trees was marked the first season, and even more so the second year. Although unirrigated, a crop was produced ranging from 200 pounds per tree to as high as 750 pounds from one particular tree.

Horse bean cover crop in Santa Clara Valley prune orchard, fertilized with complete fertilizer.

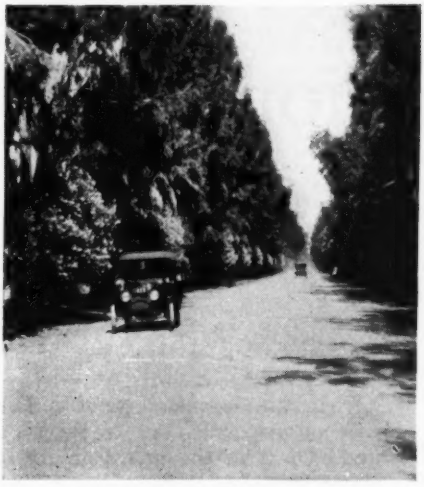
Won First Prizes

The fruit ran to exceptionally large sizes, a number of Fosters and Crawfords when ripe measuring 12 inches in circumference, and several of the Susquehannas 13 inches. Quality, firmness, and flavor also were unexcelled. The entire crop was dried, the larger amount being peeled by a method known as the sulphur process. As a rule, Fosters and Crawfords were not considered suitable for peeling due to their usual heavy shrinkage in drying. However, the shrinkage of these peaches from the potash-fed trees even when peeled was actually less than in most cases where the peel was left on. The finished product, too, was perfection in color, rich in appearance, and most appetizing in flavor.

One evidence of the improvement and desirable quality of fruits produced on this place was when the Chamber of Commerce came to me for dried fruits that they wished to use for exhibition purposes. I was pleased to let them have the fruit, but unknown to me they put them in as a special exhibit, in competition with all others. The result was that I was awarded five first prizes, and was told that I was entitled to more, but that some concessions had to be made to others. In this exhibit peeled peaches, dried pears, and silver prunes attracted particular attention as they were outstandingly superior to any others shown.

This early work with fertilizers on my own orchards was not confined to potash alone. By the use of phosphates and nitrogenous fertilizers, separately

and in combinations, their value was also definitely proved. The most outstanding effect, however, was obtained from potash whether used in the form of wood ashes or commercial forms, as plainly indicated by the increased vigor and production of grape vines; marked response on peach, prune, pear, apricot, and cherry trees in overcoming tendency to die-back; a healthier and more vigorous growth of wood; improvement in fruit-spur and bloom-bud formation; and foliage distinctly better in every respect. In fruits potash showed its value by larger production, better size, increased sugar content, and lower shrinkage in drying.



"Heavy traffic" on Kearney Ave., Fresno County, California—year 1914.

It soon became apparent that the trees had a story to relate which, if properly understood, could be used to determine their potash requirements. For instance, if nitrogen was in a reasonable supply, but potash deficient, twigs might make sufficient growth in length, but would be puny, soft, and string-like in texture. Instead of rounding out as they should, the twigs would be wrinkly in appearance and pale in color. Under these conditions in many trees such as the apricot and prune, fruitspurs would be small and puny, short-lived, and might even die before producing any fruit at all. Weak, diminutive bloom buds or entire lack of bloom buds were characteristic of poor nutrition. This lack of bloom-bud formation, which may even follow a light or moderate crop, is particularly evident in the peach when the trees have an insufficient supply of potash to draw upon. In cherry trees, fruit spurs become soft and brittle, therefore, very easily broken. Instead of forming a crown or cluster of bloom buds at the end, the spur may form just a leaf bud which will give the spur a pointed almost thornlike appearance. It was also found in the early stages of potash deficiencies that leaves would have a tendency to fold by curling inwards, would be thin in texture and lack in glossiness. This occurred before they reached that stage where the deficiency was so great as to cause mottling and leaf-scorch.

When potash was supplied in abundance, quite the reverse of the above would soon prevail. Twigs would become firm and well rounded out, with a marked increase in diameter. Their bark would be a rich, healthy, ruddy brown color. Leaves would be wide open and remain so right through the season, with a glossy, thick texture, and petioles well filled out and strong. Fruit spurs would be sturdy, and supplied with an abundance of plump, healthy bloom buds. Such spurs would last for many years in a producing state. All of these points, which I had learned from observation, proved to be decidedly helpful in enabling me to determine from examination what the trees' potash requirements were.

Sales Agency Started

Through these personal experiences in the early nineties, I had become so convinced of the value of commercial fertilizers, particularly potash, it seemed reasonable to believe that all fruit growers and other farmers, as soon as the value of commercial fertilizers could be brought to their attention, would become potential users. Thus there was

(*Turn to page* 36)

Fig. 5. On the left these hay crops received no fertilizer, while on the right an 0-8-32 was applied. From the foreground the crop is timothy and alsike, with alfalfa just beyond, and Reed canary grass where the boys are standing.

The Nutrition of Muck Crops*

By Paul M. Harmer

Muck Specialist, Michigan State College, East Lansing, Michigan

Sulphur or Manganese Sulphate. When the writer first began his studies into the causes of unproductivity on Michigan's muck soils, his attention was several times called to unproductive spots, especially in onion fields, in which the soil generally proved to be alkaline. The onions would make a good start in these alkaline spots, then invariably become dwarfed and curled during growth, and remain immature at harvest time; the celery would be yellow and often affected with cracked-stem disease; the spinach, lettuce and potatoes undersize, chlorotic and frequently unmarketable.

The condition was found to be the result of an unavailability of certain plant-food nutrients, due to the alkalinity. Of these the unavailability of manganese generally proved to be the limiting factor, but the availability of the phosphate, potash, boron, and probably other plant-food nutrients was also sometimes affected. Application of manganese sulphate in sufficient amount on such fields usually corrects the situation for one season's crop but must be repeated for the crop of the next year. Although an occasional alkaline muck will produce satisfactorily without any treatment, an application of sulphur, in a fairly fine condition and amount sufficient to correct the alkalinity and leave the soil slightly acid, thus rendering the plant-food materials more available, has proved to be a satisfactory and permanent means of

* Continued from March issue of BETTER CROPS WITH PLANT FOOD.

correcting any unproductive, alkaline muck soil. The need for manganese or sulphur is likely to be greater in a cold, wet summer or on a poorly drained field than if hotter and drier conditions prevail.

In Table 4 are presented the yields of potatoes, as a representative crop grown on a well-fertilized alkaline muck, showing the increases in bushels due to the effects of sulphur and of manganese sulphate applications. Figure 8 shows on the right the characteristic curled type of growth of onions on alkaline muck. On unproductive, alkaline muck, an annual application of 100 to 200 pounds per acre of manganese sulphate or a total application of 500 to 1,000 pounds or more of sulphur, in addition to the regular fertilization, is likely to be needed for the above-mentioned crops. Occasionally both sulphur and manganese can be used at the same time with still greater benefits. The manganese sulphate can be mixed in the fertilizer and applied

TABLE 4.—SHOWING INCREASES IN YIELD OF A REPRESENTATIVE CROP (POTATOES) RESULTING FROM THE USE OF SULPHUR AND OF MANGANESE SULPHATE ON ALKALINE MUCK. COLLEGE MUCK—EAST LANSING

Plot No.	Annual fertilization 800# per acre 0–8–24			Representative increase due to treatment. Potatoes Bu. per acre Av. 2 years 1936–1937
	Additional special treatment— Lbs. per acre			
	Manganese sulphate applied annually 1934–1937	Sulphur application		
		1934	1936	
(Control plots 2, 5, 8, 11)	0	0	0	...
1	100	0	0	80
3	100	500	500	117
4	200	0	0	116
6	200	500	500	137
7	0	500	500	54
10	0	1000	1000	101
9	0	2000	1000	113

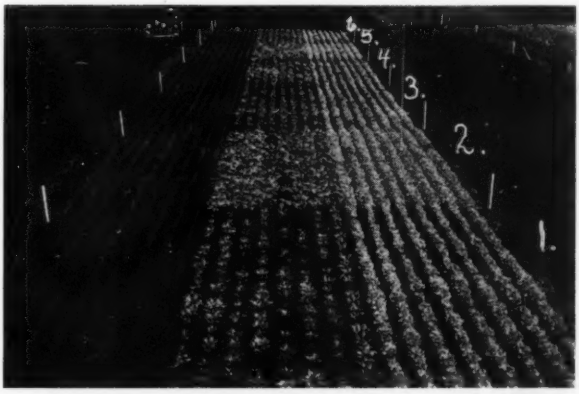


Fig. 6. Onions, spinach, and leaf lettuce, grown on plots which received the following treatments per acre: 1. Horse manure, 20 tons; 2. 3-9-18, 800 pounds; 3. Cow manure, 20 tons; 4. Sheep manure, 20 tons; 5. 3-9-18, 800 pounds; and 6. Chicken manure, 11 tons. Sheep manure proved best of the manure treatments, but none equalled the commercial fertilizer.

just before seeding, but the sulphur preferably should be applied after plowing and somewhat previous to seeding, and disked well into the soil.

Copper Sulphate. Investigation has showed that crops are likely to be benefited by the use of copper sulphate on the more acid muck soils. The more acid the muck, the greater the number of crops which may show a response to it. In addition to increases in yields, the copper produces better color of such crops as onions, spinach, lettuce and carrots, increased sugar content of carrots and beets, and improved flavor of most crops. Under Michigan conditions, most mucks with a pH of 6.0 or less will produce better yields of a number of crops when copper sulphate is applied. Benefits are more pronounced in a hot, dry summer than in a cold, wet one. Mucks with a pH of 6.0 to 6.5 may show a benefit with a few crops, while the two most responsive crops, spinach and lettuce, may give increased yields even on alkaline muck when copper sulphate is applied to the soil. In Table 6 is presented the average increases in yields of spinach as a representative crop, resulting from dif-

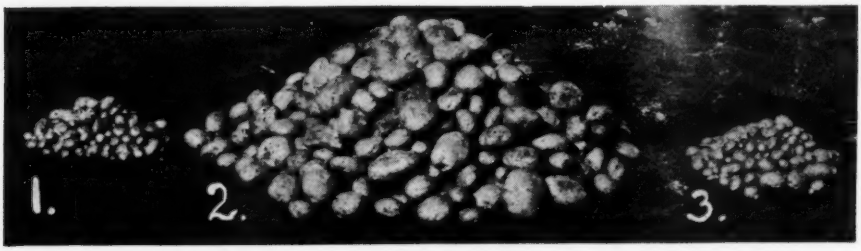


Fig. 7. These potatoes were produced on an extremely acid muck soil. With each pile from the same number of hills, the No. 1 pile had received 0-8-24 only, No. 3 marl only, and No. 2 had both marl and 0-8-24. Liming materials should not be used for potatoes unless the pH of the muck is below 4.4.

TABLE 5.—RELATIVE RESPONSE OF SEVERAL MUCK CROPS TO DIFFERENT SOIL REACTIONS AND TO CERTAIN SPECIAL TREATMENTS

No.	Most tolerant of a very strongly acid reaction	Most responsive to copper sulphate on acid mucks	Responsive to salt on most mucks	Most tolerant of an alkaline soil reaction	Most responsive to manganese sulphate or sulphur on alkaline muck	May respond to borax on all alkaline and occasional acid mucks
1	Cranberries	Spinach	Table beets	Sugar beets	Onions	Celery
2	Blueberries	Onions	Celery	Mangels	Celery	Table beets
3	Potatoes*	Lettuce	Mangels	Swiss chard	Spinach	Spinach
4	Spinach*	Carrots	Swiss chard	Cabbage	Lettuce	Corn
5	Lettuce*	Tomatoes	Sugar beets	Cauliflower	Potatoes	Sugar beets
6	Peas*	Potatoes	Turnips	Peppermint	Radishes	Cauliflower
7	Beans*	Cauliflower	Cabbage	Parsnips	Table beets	Mangels
8	Tomatoes*	Radishes	Celeriac	Carrots	Carrots	Swiss chard
9	Squash*	Beets	Kale		Peas	Turnips
10	Reed canary grass*	Peppermint	Kohlrabi		Beans	Rutabagas
11	June grass*	Sudan grass	Radishes		Sudan grass	Radishes
12	Corn*	Oats	Rape		Oats	

* Light lime and copper sulphate applications required.

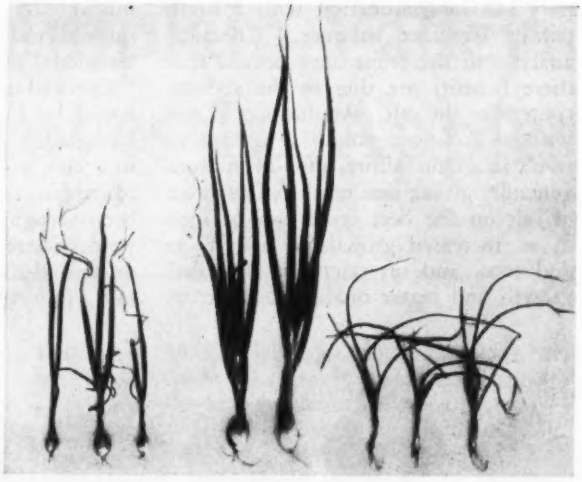


Fig. 8. These onions were all sown the same day and fertilized uniformly with phosphate and potash. The four on the left were grown on the slightly acid (pH 6.0) part of the plots while the four on the right were grown on the alkaline side (original pH 7.8). The three at the left end received no copper. Note the erect growth, with the dying back of the tips of the leaves and a premature maturity of the undersized bulbs. The fourth onion from the left came from the next plot which had received 50 pounds per acre of copper sulphate annually for four years. The erect leaves are green to the very tips and a large size bulb is likely to be developed. The three onions to the extreme right show a curled top growth and delayed bulb formation characteristic of alkaline muck. A similar growth is sometimes produced under wet conditions but, in that case, the growth will become erect as soon as drainage is improved. The fourth onion from the right came from the plot on which alkalinity had been corrected with sulphur. Manganese sulphate would have produced the same result.

ferent rates of application of copper sulphate, and on the left in Figure 8 is shown the characteristic evidence of copper deficiency in onions.

On acid muck which has received no copper sulphate in the past, an initial application of 50 pounds per acre is ample for most crops, although 100 pounds are advisable when spinach or lettuce is to be grown. In succeeding years, half the initial rate is generally sufficient, the application being repeated annually until around 250 to 300 pounds per acre have been applied.

Salt. Investigations at Michigan State College have thus far showed that 12 crops (Table 5) will be benefited on muck soil by the use of ordi-

TABLE 6.—SHOWING INCREASES IN YIELD OF A REPRESENTATIVE CROP (SPINACH) RESULTING FROM DIFFERENT RATES OF APPLICATIONS OF COPPER SULPHATE—COLLEGE MUCK, EAST LANSING

3–9–18 applied annually. 800# per acre on all plots. Av. soil pH 6.0				
Plot No.	Copper sulphate Lbs. per acre—Applied annually		Total copper sulphate applied Lbs. per acre	Spinach. Tons per acre increase in yield due to copper sulphate. Av. 4 years 1934–1937. (3 crops per year)
	1932	1933–'37		
2, 7, 11	0	0	0	....
3	50	25	175	10.3
4, 6	50	50	300	11.4
5	50	0	50	9.4
8	10	10	60	10.4
9	100	100	600	12.5
10	25	25	150	12.3
12	200	200	1200	11.3

nary salt in conjunction with a high-potash fertilizer mixture. Chemical analyses of the crops have proved that these benefits are due to the sodium content of the salt. Application of salt without sufficient potash is certain to result in a crop failure, a 0-8-24 mixture generally giving best results. The effect of salt on the beet crops can be seen in an increased growth of both roots and tops, and on celery in increased growth and better quality of the crop.

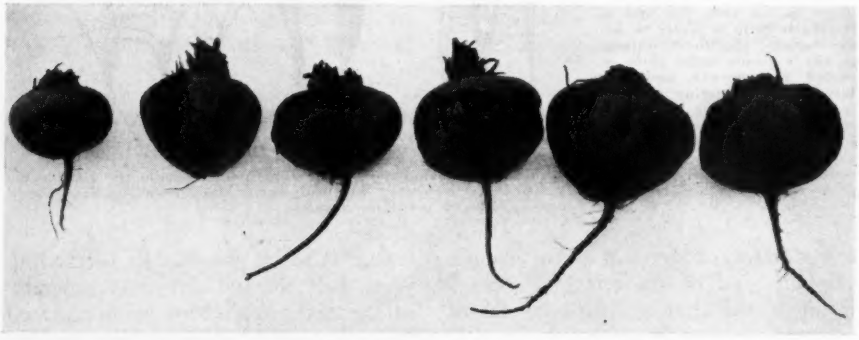


Fig. 9. Boron deficiency of table beets, manifested by the development of a decay known as girdle or canker.

Some increase in disease resistance of several of the crops has also been observed.

Muck farmers raising any of the 12 crops which benefit from salt are advised to try out salt on these crops on their mucks. An application of from 500 to 1,000 pounds per acre is likely to be sufficient for the first six listed in Table 5; from 100 to 400 pounds per acre are generally sufficient for the last six. Although the yields of some other crops are decreased from the heavier applications of salt applied just before seeding, the residual salt in the muck will have no depressing effect on any crops which may be grown the following year.

Boron. This element, ordinarily applied in the form of borax, recently sometimes has been found to be deficient in muck soils. Thus far three crops, namely, celery, sugar beets, and table beets, have showed definite deficiency symptoms on certain Michigan mucks. A total of 11 crops have showed yield benefits from borax on occasional mucks.

Cracked-stem of celery was first found by Florida investigators on the Everglades muck to be directly due to a lack of boron in the soil. Under Michigan conditions the disease has been recognized for approximately 25 years, where it generally has occurred on the alkaline muck soils. On previously unfertilized and unmanured acid mucks, it sometimes appeared the first year or two after cropping, but the deficiency was by that time entirely corrected, apparently by the boron impurities present in the heavy applications of the lower-grade fertilizer applied in past years to the celery crop. Cracked-stem on the alkaline mucks in Michigan has been prevented successfully for the past 12 years by the use of sulphur to acidify the soil, by which means the availability of the soil's boron is increased.

Because of the possibility of the occurrence of cracked-stem, the application of 25 pounds of borax per acre is advisable as a safeguard on acid mucks which previously have not been cropped to celery nor heavily fertilized. On alkaline mucks, an initial application of 100 pounds of borax should be made. Applications of borax at the rate of 50 to 100 pounds per acre, top-dressed after the cracked-stem has ap-

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The Champlain Valley Improves Its Apples

By A. B. Burrell

Professor of Plant Pathology, Cornell University, Ithaca, New York

LAKE CHAMPLAIN is a narrow body of water 136 miles long, forming most of the boundary between New York and Vermont. Apples have been grown on the farms of the Champlain Valley since the timber was cleared from the land a century or more ago, but the development of large commercial acreages is largely a matter of the past 35 years. Some of the first McIntosh trees in the United States were planted here, members of the McIntosh family having personally traveled through the region to sell the original stock. The McIntosh has been the leading variety for about 20 years, and constitutes about three-fourths of the total apple production.

Right: Twig with leaf-scorch and defoliation from tree on exceptionally poor soil which received abundant nitrogen, but no potassium, mulch, or manure. Left: Comparable twig from an adjacent tree which was in equally poor condition previous to two annual potassium treatments.

When I first went to the Champlain Valley to do experimental work in 1925, I found mostly slow-growing orchards, producing rather light crops of very highly colored apples which commanded top prices. At that time, most growers used limited quantities of manure in their orchards together with occasional light applications of nitrate of soda and in some cases, a little phosphorus. Most bearing orchards were in sod, but the grass growth was not always heavy. Under these conditions it was not difficult to show sensational increases in yield and growth through liberal applications of any of the common nitrogenous fertilizers. Within three years the use of nitrogen increased several hundred per cent, and has been maintained at a high level ever since.

At this stage a limited number of tests failed to show any direct tree response from elements other than nitrogen. Certain abnormalities in the trees, however, were noted from time to time.

One group of associated symptoms included internal and external cork of the apple fruits, die-back, rosette, a form of leaf-scorch, and internal bark necrosis. It was found that irrigation would partially control the internal cork in the fruits, but this was impractical and did not settle the fundamental nature of the trouble. A little later it was found that die-back, rosette, and two types of leaf-scorch (caused respectively by deficiency of boron and of potash)

were partially controlled by four years of any of the following treatments:

1. Continuous heavy mulching with hay.
2. Annual heavy ring of manure.

already high sodium content of the soil. Most investigators have had good results from incorporating some such amount as 2 pounds of borax or boric acid per 100 gallons of regular spray

TABLE 1.—RATES FOR FIRST APPLICATION OF BORAX TO TREES OF DIFFERENT SIZES *

Length of time tree has been in orchard	Approximate trunk diameter one foot above ground	Amount of borax for application on soil
Years	Inches	Ounces
0 to 3	½ to 2½	None
4 to 6	3½	2
7 to 9	5	4
10 to 12	7	6
13 to 15	10	8
16 to 24	14	8 to 12
25 and more	15 and more	12 to 16

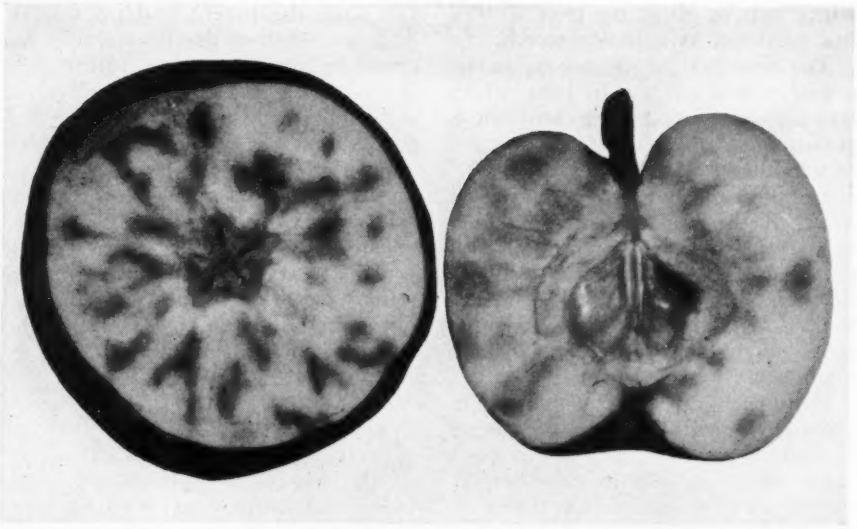
* The size of a tree is more dependable than the age for determining the amount of borax needed. If boric acid is used, two-thirds the amount shown would be sufficient. When a second treatment is made after an interval of three years, it may be possible to reduce the amount by one-third.

3. Omission of nitrogen in sod orchards whether or not potassium was applied. (Nitrogen-deficiency thereby reduced growth and yield to unprofitable levels.)

The commercial use of the mulch method gradually gained, but it still was not clear why the mulch was beneficial. The next step was the discovery that boron would prevent internal and external cork, die-back, rosette, and one form of leaf-scorch. This was confirmed by numerous orchard tests, and soil applications of borax were made by most Champlain Valley fruit growers as suggested in Table 1.

The result was the almost complete elimination of these symptoms from the region. On most points the results of boron experiments with apples in various parts of the world have been remarkably consistent. Borax containing 11.34% boron and boric acid containing 17.49% have been equally effective when used in such quantities as to supply equal amounts of boron. In New York State, we use borax because it is cheaper per unit of boron. In British Columbia, they use boric acid because they prefer not to build up the mixture in early summer, as a substitute for soil application, but some questions remain about the effectiveness and safety of the spray method of applying boron. Incidentally, the various tree-

Die-back, a symptom which develops only where boron deficiency is severe. Leaves are dwarfed, narrow, and brittle.



Internal cork, late-season type, the most common symptom of boron deficiency in apples. In many varieties the brown areas are principally near the core.

injection methods of supplying boron are too injurious for commercial use, though they were the tools by which the need for boron was discovered in several apple orchard regions.

Passing mention should also be made of the possible injury from boron. Under the conditions of the Champlain Valley, however, no evidence of injury has been secured when borax has been applied to the soil as suggested. Excessive rates or careless distribution can cause injury, a characteristic of boron injury being fading of color near the midrib of the leaf, especially near the base.

Boron Benefits Alfalfa

One other place where boron may come into the picture deserves mention. Of recent years Essex County Agricultural Agent Ray Bender and the Agronomy Department at Cornell have been accumulating evidence to show that borax used in connection with alfalfa may increase the vigor and longevity of this forage and cover crop plant. This may be of importance, since the alfalfa stands of the region often thin out more rapidly than can be explained by other known factors. The possible relation of potash deficiency to unsatisfactory alfalfa performance is covered later in this paper.

But even after the diverse symptoms of boron deficiency in apple trees were cleared up, there remained certain young blocks of apple trees with leaf-scorch. One characteristic of this leaf-scorch was the presence of brown staining preceding and accompanying the necrotic leaf margin. The symptoms were distinct from those caused by arsenical or sulfur sprays, by indiscreet overdoses of cyanamid or other fertilizers, or from simple water shortage. They so closely resembled those overcome in England by potassium applications, and occurred in sand-culture trees from which potash was withheld, that new experiments involving the use of potassium were inaugurated. Although previous experiments with potash had given negative results, it still seemed possible that potash might be needed on certain soils.

In these new experiments, the materials were applied to the soil surface in a very concentrated band, beneath the branches, or were placed in shovel holes in contact with apple tree roots. Such experiments were located in orchards

where part or all of the trees showed this particular type of leaf-scorch.

The first year of treatment, no response was apparent. In 1940, which was the second year for experiment I, potash caused an amazing improvement in trees that previously suffered severely from leaf-scorch and general poor vigor, although the leaf-scorch has not yet been completely overcome. This was on an exceptionally infertile soil. In experiment II where the trees were not so bad originally, leaf-scorch was eliminated after the third annual potash treatment.

Fortunately, the Pomology Department at Cornell was able to collaborate by making potassium analyses of leaves from trees involved in these experiments. The treatment was found to have increased the potassium content from about one-third of one per cent on the untreated scorch trees to over one per cent on the treated trees. Scorch was largely overcome both where the potash was dug in and where it was applied in a narrow band on the surface of the soil.

In part of this work muriate of potash was used, in part, sulphate of potash. The results do not show whether either compound was superior to the other. The annual applications usually were from 3 to 5 pounds per tree 7 to 10 years of age. The objective was to apply as much as seemed reasonably safe since the urgent problem was to find out whether the trees would respond to potassium rather than to seek the minimum effective application. It is possible that satisfactory commercial results might be obtained from lighter annual applications or from liberal applications once in several years. If we were to start with trees seriously deficient in potassium, it might be expedient to try two conservative applications the first growing season in the hope that the potassium content might be raised to a normal level as soon as possible.

Potassium for Clovers

In the orchard where these experiments were conducted, alfalfa, alsike clover, and medium red clover exhibited the white spotting near the leaf margin commonly pictured as a symptom of potassium deficiency. Experience in the Champlain Valley with certain farm crops indicates that potash may sometimes be beneficial, especially where manure has not been used freely in the rotation and where the soil is sandy. The use of potassium for clovers on the sandier soils of New England has been recommended for some years, but emphasis in New York State usually has been on phosphorus and lime. Clinton County Agricultural Agent R. W. Foote and the Cornell Agronomy Department are conducting tests to see whether or not potassium should be included in the fertilizer mixture for farm rotations on at least some of the lighter soils of the region.

Adoption of a policy of using liberal amounts of nitrogen about 14 years ago greatly increased yield and growth of Champlain Valley apple orchards. It soon became apparent that on some soils, still better tree performance was obtained by the use of

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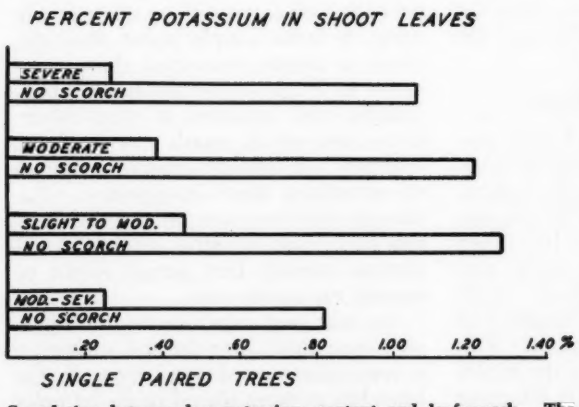

Correlation between low potassium content and leaf-scorch. The upper bar in each pair represents a tree which did not receive potassium; the lower bar a comparable adjacent tree which had three annual applications of muriate or sulphate of potash.

Preparing celery for market on a wet, rainy day. Note sprinkler system and discarded cuffs.

Keeping Celery High in Quality

By L. H. Hartwig

Columbia, Missouri

TYPICAL of Pennsylvania's many outstanding truck farmers is Frank Haug of Lycoming County. His garden crops are equal to or better in quality than any grown in the State. The standard of the 18 acres of celery which he grows each year is particularly high.

One should not be surprised that Frank Haug does such an excellent job of growing celery. "My father grew Pascal celery as far back as I can remember. I helped him care for his crops, and now I'm in the same business myself. It would be hard to tell exactly when I did start helping with the celery crop, but I know that I wasn't very old," he commented when asked how long he'd been in the celery business and where he'd gotten his early training. One thing is true, Frank Haug, now in his prime, has had plenty of experience growing this crop which requires careful attention throughout the entire season, and he has profited by all his experience.

Yes, he grows mighty good celery. Anyone who has seen or eaten any of it will testify to that. State agricultural extension specialists, whose advice Haug has followed more than once, like to point to his methods as the kind that produce results, the kind they like to see other growers follow, for they know full well that only by the right practices can reasonable profits be made on this ticklish crop.

The Haug farm is located alongside

the swiftly flowing Susquehanna river in a picturesque setting not far from the city of Williamsport. Once that river was full of floating logs, but now its main duty is carrying away surplus waters of melting snows and pouring rains. The soil is black and fertile, not too sandy, but just the sort that it takes to grow the kind of celery critical customers like. Too much sand in the soil, Haug explained, has a tendency to make the plants ribby, and ribby stalks don't please the palates of "persnickity" celery munchers.

That black loam soil is fertile, as good river bottom land should be, but even so every opportunity is taken to increase the natural richness. Green cover crops are grown and plowed under to improve the organic content, but that isn't enough. Every year an attempt is made to apply at least 20 tons per acre of manure from a cattle feedlot. This is spread in late winter or early spring.

Fertilizers Recommended

Every year, within a week before the plants are to be set in the field, a ton per acre of a 5-10-5 fertilizer is applied. This is worked well into the soil. If it so happens that insufficient barnyard manure is available, a side-dressing of 300 pounds per acre of the 5-10-5 fertilizer is made. The soil is tested regularly, and lime applied when necessary to keep the ground nearly neutral.

From this it is to be noted that this grower believes in providing his crop with abundant supply of available plant food. On medium loam soils receiving manure or on clover sods, the Pennsylvania Experiment Station actually recommends 1,000 to 1,250 pounds of 3-12-6 or 4-12-4. Where no manure or clover sod is used, they recommend 1,250 to 1,500 pounds of a 3-12-6 per acre, and on sandy loam soils they recommend 1,200 to 2,000 pounds of a 3-12-6 or equivalent amounts of plant food in another analysis in the same ratio.

Although Pennsylvania has very few muck soils as compared to other States, its recommendations for celery grown on recently cleared muck are 2,000 to 2,500 pounds of a 3-12-18 per acre or from 3,000 to 3,750 pounds of a 2-8-12. Where grown on muck soils which have been well fertilized for 10 years or more, they recommend from 2,000 to 2,500 pounds of a 4-8-12.

What kind of celery does Frank Haug grow? Well, his years of experience have taught him that for his market, Emperor fills the bill most satisfactorily. There are a number of varieties that might do almost as well, but not quite. California Pascal, for example, would be easier to handle, and would perhaps meet with the satisfaction of many buyers, but it lacks the fine quality and crispness of the Emperor variety.

Haug has found that he can secure the best results by growing his own plants, so he does just that. And it takes a good many plants to set 18 acres, about 425,000 to be more or less exact. The seeds are started in steam-sterilized soil. Sterilization of the seedbed kills any disease bacteria that may have been lurking in it awaiting the opportunity to carry on their parasitic activities on young, tender celery plants. Plants started in unsterilized soil begin life with at least one strike against them. As a precaution against molding of the seeds in the seedbed during germination, the day and night temperatures in the greenhouse are kept as nearly as possible at 60 degrees Fahrenheit.

Now here's the thing that has done perhaps more than anything else to place Frank Haug among the top-notch celery growers. It's the rigidity with which he goes about controlling insects and disease. Actually, he doesn't control insects or disease. He absolutely prevents them from gaining a foothold by carrying on a continuous, relentless battle against possible infection or infestation.

Spraying begins at the time the plants are in the seedbed. From then on they're sprayed weekly, depending somewhat of course upon the diseases or insects that may threaten. As a re-

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PICTORIAL

FRECKLES—ONE OF THE FIRST CROPS OF THE SEASON.

Spring on the farm brings new life

And hard work for everybody

Above: Beaver dams, such as this, are a great help in flood control.

Below: A planting of corn, with beans between the hills, in Georgia.

The Editors Talk

Something New in Fertilizer Laws

With new developments in fertilizer manufacture, there is a general tendency toward provisions discouraging the manufacture of analyses with relatively low plant-food content and encouraging the making of high-analysis goods which are more economical per pound of plant food delivered on the farm. Cognizance is also being taken of the increasing need for the secondary plant nutrients, and the newer laws are providing for the guarantee and control of these elements.

North Carolina has passed a new fertilizer law containing some unusual provisions. Regarding same, we are indebted to Louis H. Wilson, Editor of the Publications Division, N. C. Department of Agriculture, for the following news story:

"A North Carolina farmer next season, for the first time in the agricultural history of the State, can look at a bag of fertilizer marked 'low grade' and determine without uncertainty that he is buying an unrecommended mixture, D. S. Coltrane, assistant to the Commissioner of Agriculture said today in reviewing the 1941 Fertilizer Law.

"The Fertilizer Law becomes effective on December 1.

"With the general approval of farmers, farm organizations, farm leaders, the N. C. Experiment Station and State College, manufacturers, and others, the fertilizer law was amended and 'streamlined' by the 1941 Legislature, giving the State a statute termed 'unquestionably essential in the promotion of more economical use of plant food.'

"Fertilizer is considered and labeled on the basis of the number of plant-food units contained in the bag. Plant-food units are expressed in terms of nitrogen, phosphoric acid and potash, although there are other 'secondary' plant foods that may be guaranteed. For instance, a 4-8-4 grade would contain four units of nitrogen, eight units of phosphoric acid, and four units of potash, thus making a 16-unit fertilizer. All of which is by way of explaining that a 16-unit mixture is the lowest grade recommended by the research leaders at the N. C. Experiment Station.

"When the fertilizer law amendments were presented to the Legislature, there was considerable debate and objection to the proposal prohibiting manufacturers from selling a mixture containing less than 16 units of plant food, and opponents to the amendment contended that farmers should be permitted to buy any generally used grade they desired. Proponents of the amendment to limit grades to not less than 16 units contended their proposal was both economically and agronomically sound. A compromise was reached to the satisfaction of farmers, manufacturers, agronomists, and farm leaders.

"There is no fertilizer law in the United States comparable to the North Carolina act, nor is there a law that gives farmers and honest manufacturers any greater protection, in the opinion of Coltrane.

"The compromise amendment, 'designed to save farmers money and give them greater information to be used in more intelligent buying of all mixtures,' reads as follows:

" 'Any mixture containing two plant-food ingredients, or mixed fertilizer containing less than 16 units of plant food (total nitrogen—available phosphoric acid—potash) shall be branded Low Grade and shall carry a red tag reading as follows:

" 'This Is a Low Grade Fertilizer.

" 'It costs too much per unit of nitrogen—available phosphoric acid and potash because it contains only 14 or 15 units (whichever the case may be) of these plant foods. You are paying too much for bagging, freight, labor, etc., on too much inert material (such as sand filler).'

"Thousands of dollars have been spent by research agencies, supported by public funds, in the interest of finding the best suitable fertilizers for all crops in North Carolina. Generally, research leaders and the N. C. Experiment Station do not recognize any grade of fertilizer containing less than 16 units of plant food. However, farmers can continue to buy grades containing as little as 14 units of plant food under the present (1941) law.

"When a farmer goes to buy his fertilizer, it is his privilege to buy any grade (14 or 15 unit goods) that he desires, but the 'minimum plant food' amendment calls his attention to 'unrecommended grades' and he buys such goods with the full knowledge that they are not approved by the Experiment Station, research leaders, and the agricultural leaders who have spent much time and money in research and for experiments in order that all growers may be informed as to the best fertilizers for their crops."

According to Census

"A general reduction in acreage devoted to staple farm crops, but with a general increase in production per acre, are indicated in the 1940 Census report on crop acreages and production released recently by Vergil D. Reed, Acting Director of the Census. Acreage devoted to the staple grain crops, hay, cotton, tobacco, potatoes, and a few more of the important farm products amounted to 301,103,691 in 1939, compared with 345,212,082 in 1929. Some of the important staple crops, despite this decreased acreage, showed an actual increase in physical volume and practically all showed a pronounced increase in production per acre," according to a recent statement from the U. S. Department of Commerce.

More from fewer acres reflects improved management. That a more intelligent use of fertilizers has played an important part is evident. Research, not only in the most profitable amounts of plant food to use but in proper placement, has been active during the past decade. It has not ceased, and new knowledge constantly being brought to light assures further efficiency in land use.

In the report, it was interesting to note that Iowa led all other States in the production of corn, Kansas in wheat, Iowa in oats, Texas in cotton, North Carolina in tobacco, Minnesota in hay, and Maine in Irish potatoes.

Our New Address: On April 28, The American Potash Institute moved its main offices to 1155 16th Street, N. W., Washington, D. C., taking a whole floor in the building newly acquired by the American Chemical Society. The editorial office of Better Crops With Plant Food is also located at this address.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ Nine of the 11 fertilizer ratios selected by representatives of the agricultural colleges and fertilizer industry for New England seem to meet Connecticut needs, according to Extension Bulletin 302, "Fertilizer Grades for Connecticut." In contrast, 60 ratios represented by 65 grades of mixed fertilizer were sold in the State last year. The bulletin gives recommendations of ratios or grades, together with rate of application, for all classes of crops and plantings grown in the State. The ratios include 0-1-1, 1-1-1, 2-1-1, 2-1-2, 1-2-1, 1-3-1, 1-2-2, 1-4-2, 1-4-5. Among the fertilizers in these ratios are 0-20-20, 7-7-7, 10-10-10, 10-5-5, 8-4-8, 5-10-5, 8-16-8, 4-12-4, 5-15-5, 5-10-10, 8-16-16, 5-8-7, 4-8-10, 3-12-6, 4-16-8, 4-16-20.

¶ Cornell Extension Bulletin 455, "Approved Fertilizers for New York," is a condensed but comprehensive version of Bulletin 281 (Revised, January 1941), entitled "Fertilizer Recommendations for New York." It is a contribution from the Departments of Agronomy, Vegetable Crops, Pomology, and Floriculture and Ornamental Horticulture of Cornell University. Tables give the fertilizer grades and rate of application for field crops, vegetable crops, fruits, and ornamentals growing under various conditions in the State. When large amounts of manure have not been used recently, complete fertilizers are recommended except in the case of legume crops or small grain following legume sod, in which case a phosphate-potash mixture is suggested. The bulletin is a very handy reference for growers with fertilization problems.

¶ Of practical help to farmers in the Province of Quebec, Canada, is the latest booklet of "Recommendations of the Provincial Fertilizer Board for 1941," distributed by the Department of Agriculture, Quebec. Suggestions as to the mixtures given herein are made on the basis of satisfactory results under farm practices.

Most of the recommendations center around 14 grades. They are: 2-12-10, 4-8-10, 5-8-10, 2-12-6, 2-16-6, 4-12-6, 2-12-8, 3-8-15, 0-16-6, 0-16-10, 0-8-16, 2-8-16, 5-8-7, and 9-5-7. The Board states that there is a pronounced trend toward the use of ready mixed fertilizers as opposed to separate ingredients which at one time were almost exclusively used. The Board considers that unless the difference in price justifies the purchase of separate ingredients for home-mixing, farmers should give preference to ready mixed fertilizers, because of their usual superior mechanical condition.

"Lime and Fertilizer Requirements for Asparagus," Agr. Exp. Sta., Newark, Del., Hort. Pamp. No. 1, Feb. 1941, E. P. Brasher.

"Fertilizer Experiments with Potatoes on The Marl Soils of Dade County," Agr. Exp. Sta., Gainesville, Fla., Bul. 352, Dec. 1940, W. M. Fifield and H. W. Wolfe.

"Commercial Fertilizers for Nebraska," Agr. Ext. Serv., Lincoln, Nebr., Cir. 149, Jan. 1941, M. D. Weldon and J. W. Fitts.

"Fertilizer Recommendations for New York," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 281, Rev. Jan. 1941.

"Onion Fertilizer Experiments at Laredo, Big Wells, and Eagle Pass, Texas," Agr. Exp. Sta., College Station, Tex., Bul. 596, Jan. 1941, Leslie R. Hawthorn.

"New Fertilizer Materials," U. S. D. A., Washington, D. C., Cir. 185, Rev. Dec. 1940, Albert R. Merz.

"Results of Cooperative Tests of TVA Plant-

food Materials by the Valley States Land Grant Colleges. Part 1: Agricultural Experiment Station Results," U. S. D. A., Washington, D. C., Nov. 1940.

Soils

¶ Dr. H. H. Bennett, Chief, Soil Conservation Service, gives a popular presentation of the story of soil waste in this country and steps toward conservation in a new Department of Agriculture publication, "Soils and Security." Containing many appropriate illustrations and written in Dr. Bennett's usual free style, "Soils and Security" tells us facts that concern not only the farmer as the first loser from erosion, but everybody. As long as erosion continues to cut away land and impoverish farm people at the present rate, we can never hope to achieve a truly sound and lasting national prosperity.

The laws of soil conservation have been so violated in the United States that more than 280 million acres have been virtually ruined by wind and water erosion. This vast area, nearly eight times the land surface of Wisconsin, was well covered for the most part with a fairly deep layer of fertile soil. As far as records can show, this Nation has wasted its soil resources faster than any other nation that ever attempted extensive agriculture.

The last part of "Soils and Security" concerns work of the Soil Conservation Service and other conservation agencies, especially soil conservation districts organized by farmers throughout the country. The work to date has already controlled erosion, for all practical purposes, on farms comprising about 20 million acres in private ownership, Dr. Bennett says. A solution has been found, or at least partially so, for every type of erosion that occurs on American agricultural land. But despite all this encouraging progress, the country is not yet moving fast enough in the direction of conservation and better land use. Countless tons of fertile soil still go coursing down our rivers with every hard rain. Dust clouds still rise over the Plains whenever there is prolonged dry weather.

Although defenses against rain and wind have been developed and tested, a huge area of farm and range lands remains largely untouched by conservation work. The real job of soil conservation has only just begun.

"Location and Design of Broad-base Ridge Terraces," "Constructing the Broad-base Ridge Terrace," and "Maintenance and Care of Broad-base Terraces," Agr. Ext. Serv., Honolulu, Hawaii, Circs. 101, 102, and 103, Jan. 1941.

"Alkali Reclamation Investigations," Agr. Exp. Sta., Moscow, Idaho, Bul. 233, Oct. 1940, Robert S. Snyder, Mark R. Kulp, G. Orien Baker, and James C. Marr.

"The Migration of Iron and Manganese in Colloidal Systems," Agr. Exp. Sta., Urbana, Ill., Bul. 472, Dec. 1940, Eric Winters.

"Soil Management for Iowa Cropland and Pasture," Agr. Exp. Sta., Ames, Iowa, S-63, Rev. Jan. 1941.

"Landform Types," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 175, Feb. 1941, Louis A. Wolfanger.

"A Study of Land Utilization in Providence County, Rhode Island," Agr. Exp. Sta., Kingston, R. I., Bul. 275, 1940, Basil E. Gilbert.

"Better Farms and Homes for Your Neighborhood," Agr. Ext. Serv., Morgantown, W. Va., Cir. 328, Nov. 1940, Walter C. Gumbel.

"Supplemental Irrigation," U. S. D. A., Washington, D. C., Farmers' Bul. 1846, Oct. 1940, F. E. Staebner.

"The Story of Soil Conservation in the South Carolina Piedmont, 1800-1860," U. S. D. A., Washington, D. C., Misc. Pub. 407, Nov. 1940, Arthur R. Hall.

Crops

¶ Fertilizer experiments conducted with Spanish peanuts in Georgia show that best increases were produced on most soils from fertilizers supplying 24 pounds nitrogen, 24 pounds phosphoric acid, and 24 pounds potash per acre. Professor U. R. Gore, in Georgia Experiment Station Bulletin 209, "Culture and Fertilizer Studies with Peanuts," says these plant nutrients may be applied in 400 pounds per acre of a 6-6-6 fertilizer before planting, or 300 pounds of a 3-8-8 plus a side application of 100 pounds nitrate of soda per acre. Another way to apply the fertilizer is to put 150 pounds of superphosphate per acre under the peanuts and side-dress with a mixture of 150 pounds nitrate of soda and 50 pounds muriate of potash.

On soils of average fertility in a rotation where other crops have received the average amount of fertilizer, it will often pay to fertilize Spanish peanuts, provided a good stand is obtained, proper cultivation is given, and the price of peanuts bears a favorable ratio to the price of fertilizer. On good soils previously heavily fertilized, little increase of peanuts may be expected from the use of fertilizer. A mixture of phosphate and potash is suggested for farmers who think their North Carolina Runners need fertilizer. The Runner type, so far, has indicated little or no response to fertilizer, especially nitrogen, Professor Gore states.

The bulletin describes the varieties of peanuts grown, culture and harvesting methods, and diseases of peanuts, giving control measures.

¶ Another interesting publication of this Station is Professor S. V. Stacy's Circular 126, "Corn Varieties, Hybrids, and Cultural Practices." In this the author gives the variety performance results of the open-pollinated and hybrid types in tests conducted at Experiment, Georgia, for a number of years. Long-time experiments with cultural practices are also discussed.

It is said that yields of 150 bushels or more of corn per acre have been produced in Georgia, yet the average yield for the State remains pitifully low. The crop is grown on many acres which are entirely too poor to be used for this purpose. Much of this land can be improved by practicing proper crop rotation and turning under green manure crops. The wide variation in variety yields grown under the same conditions should encourage corn growers to plant superior strains. Excellent advice on these, both for the open-pollinated and hybrid types, is given.

Corn planted in a rotation with a highly fertilized crop will need from 150 to 200 pounds of nitrate of soda or its equivalent in commercial nitrogen. When the rotation does not include a highly fertilized crop, corn should be fertilized with about 200 pounds of a complete fertilizer and top-dressed when knee high with 100 to 150 pounds of some nitrogen material.

The soil type on which the tests were conducted was Cecil sandy clay loam of medium fertility. The Cecil soil series is by far the most important and widely distributed soil of the Piedmont Plateau and has a wide crop adaptation.

"Studies of the Ripening of Marsh Grapefruit in Arizona," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 89, Jan. 15, 1941, R. H. Hilgeman.

"Science, Servant of Agriculture," Agr. Exp. Sta., Berkeley, Calif., Rpt. of the Agr. Exp. Sta., July 1, 1938, to June 30, 1940, C. B. Hutchison, S. B. Freeborn, and Henry Schacht.

"Alien Plants Growing Without Cultivation in California," Agr. Exp. Sta., Berkeley, Calif., Bul. 637, July 1940, W. W. Robbins.

"Sixty-fifth Annual Report of the Ontario Agricultural College and Experimental Farm, 1939," Ont. Agr. Exp. Farm, Guelph, Ont.

"Making Money from Potatoes," Agr. Ext. Serv., Storrs, Conn., Bul. 292, Feb. 1940, Albert E. Wilkinson.

"Onions," Agr. Ext. Serv., Storrs, Conn., Bul. 293, May 1940, Albert E. Wilkinson.

"Cantaloupes," Agr. Ext. Serv., Storrs, Conn., Bul. 294, May 1940, Albert E. Wilkinson.

"Cucumbers," Agr. Ext. Serv., Storrs, Conn., Bul. 295, June 1940, Albert E. Wilkinson.

"Celery," Agr. Ext. Serv., Storrs, Conn., Bul. 296, June 1940, Albert E. Wilkinson.

"Paperwhite Narcissus," Agr. Exp. Sta., Gainesville., Fla., Bul. 353, Dec. 1940, R. D. Dickey.

"Illinois Corn Performance Tests, 1940," Agr. Exp. Sta., Urbana, Ill., Bul. 474, Jan. 1941, R. R. Copper, G. H. Dungan, A. L. Lang, J. H. Bigger, Benjamin Koehler, and Oren Bolin.

"Growing Pumpkins and Squashes," Agr. Ext. Serv., Orono, Maine, Cir. 135, Jan. 1941, William S. Plumer.

"Agricultural Experiment Station Report, Two Years Ended June 30, 1940," Agr. Exp. Sta., East Lansing, Mich.

"The Detection, Distribution and Mobility of Certain Elements in the Tissues of Plants Growing Under Different Conditions as Determined by the Spectrographic Method," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 176, Feb. 1941, R. P. Hibbard.

"Soybeans for Minnesota," Agr. Ext. Div., University Farm, St. Paul, Minn., Ext. Bul. 134, Rev. Oct. 1940, A. C. Arny, W. W. Brookins, and R. E. Hodgson.

"Building Soil, Security, and Self-reliance," Agr. Ext. Serv., Columbia, Mo., 1940 An. Rpt., Cir. 427, Mar. 1941.

"Science and the Land," Agr. Exp. Stas., New Brunswick, N. J., An. Rpt., 1939-40.

"Bloom Period and Yield of Apples," Agr. Exp. Sta., Wooster, Ohio, Bul. 618, Jan. 1941, C. W. Ellenwood.

"Oklahoma Wheat Improvement, 1939-40," Agr. Exp. Sta., Stillwater, Okla., Cir. 91, Jan. 1941, Horace S. Smith.

"The Cotton Contest—1940—for Better Yield and Staple Value," Agr. Ext. Serv., Clemson, S. C., Cir. 190, Feb. 1941.

"Farm Research in South Dakota," Agr. Exp. Sta., Brookings, S. Dak., 53rd An. Sta. Rpt., July 1, 1939—June 30, 1940.

"Better Crops and Methods in the Farm Garden," Agr. Ext. Serv., Knoxville, Tenn., Pub. 230, Rev. Jan. 1941, W. C. Pelton.

"Garden Planning in a Home Food Supply Program," Agr. Ext. Serv., Knoxville, Tenn., Pub. 236, Feb. 1941, W. C. Pelton.

"Growing a Defense Garden," Agr. Ext. Serv., Knoxville, Tenn., Pub. 247, Jan. 1941, W. C. Pelton.

"Cabbage Variety and Fertilizer Tests in Cameron County," Agr. Exp. Sta., College Station, Texas, 692 Prog. Rept., Sept. 5, 1940, J. F. Wood.

"Research Aids Utah Agriculture, Biennial Report 1938-1940," Agr. Exp. Sta., Logan, Utah, Bul. 294, Dec. 1940.

"Bitter Pit of Apple. 1. In Orchard and in Storage," Agr. Exp. Sta., Burlington, Vt., Bul. 467, Dec. 1940, M. B. Cummings and R. G. Dunning.

"Agriculture of Vermont—Twentieth Biennial Report of the Commissioner of Agriculture, 1939-1940, St. Dept. of Agr., Montpelier, Vt.

"14th Biennial Report of the West Virginia Department of Agriculture, 1939-1940," St. Dept. of Agr., Charleston, W. Va.

"Growing Raspberries & Blackberries in Wisconsin," Agr. Ext. Serv., Madison, Wis., Cir. 280, Rev. Oct. 1940, J. G. Moore.

"Lettuce Growing," U. S. D. A., Washington, D. C., Farmers' Bul. 1609, Rev. Oct. 1940, W. R. Beattie.

"Comparative Chemical Composition of Juices of Different Varieties of Louisiana Sugarcane," U. S. D. A., Washington, D. C., Tech. Bul. 688, Oct. 1939, C. A. Fort and Nelson McKaig, Jr.

"Harvesting Pyrethrum," U. S. D. A., Washington, D. C., Cir. 581, Jan. 1941, A. F. Sievers, M. S. Lowman, and W. M. Hurst.

"Development of Interspecific Tomato Hybrids of Horticultural Value and Highly Resistant to Fusarium Wilt," U. S. D. A., Washington, D. C., Cir. 584, Jan. 1941, William S. Porte and Frederick L. Wellman.

"Range Conservation Practices for the Great Plains," U. S. D. A., Washington, D. C., Misc. Pub. 410, Dec. 1940, B. W. Allred.

"Leaders on the Land, A Report of Cooperative Extension Work in Agriculture and Home Economics in 1939," U. S. D. A., Washington, D. C.

Economics

¶ The Bulletin "Analyses of Commercial Fertilizers, Spring Season 1940," published by the North Carolina Department of Agriculture, contains so much information relative to the fertilizers used in the Nation's No. 1 fertilizer-consuming state that it is virtually a handbook on fertilizer consumption for North Carolina. In the third article in The Bulletin, D. S. Coltrane points out that as a result of efforts to reduce the number of grades offered for sale in the State nearly 96% of the total fertilizer tonnage sold in 1939 and 1940 was represented by 35 grades, which is a virtual reduction from 202 grades in 1938 to 35 grades in 1939 and 1940. Mr. Coltrane attributes the success of this program to the splendid cooperation of the farmers, farm agencies, and fertilizer manufacturers.

During the spring months of 1940, North Carolina farmers used 901,636 tons of fertilizer and fertilizer materials. Sales of mixed fertilizer for the 1940 spring season, January 1 through June 30, totaled 728,963 tons or about 17% less than the 850,735 tons used during the corresponding period in 1939. Despite the fact that 95.7% of the total fertilizer sold in the State represented 35 grades, there were 148 grades included in the remaining 4.3% of sales.

It is pointed out that the relatively high priced low analysis materials are now being replaced by lower priced high analysis synthetic or chemical products. The cost of fertilizers on the farm is determined by two major factors: First, by the price of materials and second, by the cost of manufacture, bags, and distribution.

The cost of distribution is around $10 per ton regardless of cost of the product. Thus, North Carolina farmers by changing from 3-8-3, 2-9-3, and other 14 or 16 unit fertilizers to a fertilizer containing from 17 to 21 units per ton, such as 3-8-6, 3-10-6, 4-12-4, 5-10-5, and 3-12-6, would eliminate filler and could save from 12 to 15% on their fertilizer bill. This saving to the farmers of the State would amount to more than $1,000,000. For example, the 2-8-4 is recommended for peanuts, so is 3-12-6. However, if the farmer used 3-12-6 in-

stead of 2-8-4, two tons of 3-12-6 would be equivalent to three tons of 2-8-4. Two tons of 3-12-6 cost $52.78, whereas three tons of 2-8-4 cost $62.85, representing a saving of $10.07 or 16% by buying the higher grade fertilizer.

Other articles include "Fertilizers for Different North Carolina Crops" by C. B. Williams, giving recommendations for different crops in different parts of the State; "Fertilization of Truck Crops in North Carolina" by E. R. Collins, including data on different crops and different soils; "Discussion of Tobacco Fertilizers" by E. G. Moss; "Fertilization of Peanuts in North Carolina" by E. R. Collins and H. D. Morris; "American Potash Supplies" by J. W. Turrentine; "Soil Testing and Plant Growth" by I. E. Miles; "The Soil Acidity Problems in the Southeastern States" by H. P. Cooper; and "The Different Forms of Agricultural Lime and Their Uses" by A. L. Grizzard. Another section is devoted to recommended field and vegetable crop varieties for North Carolina. On the whole, the publication should prove a very helpful guide to farmers and others interested in agriculture in North Carolina and the Southeastern States.

¶ The Department of Agronomy of New York State College of Agriculture in cooperation with the National Fertilizer Association has published in Mimeo No. 618, "Fertilizer Tonnage for New York," some very interesting data relative to fertilizer consumption in the State of New York. The report covers the calendar year 1940. During that period total sales of all fertilizers amounted to 369,911 tons. Total sales of mixed goods amounted to 212,920 tons consisting of 43,582 tons of less than 20 units, 157,658 tons of between 20 and 30 units, and 8,972 tons containing more than 30 units of plant food. Of the total sales of 133,549 tons of superphosphate materials, only 1,849 tons contained more than 20% superphosphate. There were 16,095 tons of nitrogenous materials, 1,655 tons of potash salts, and 5,692 tons of other fertilizer materials sold.

The leading grades of mixed fertilizers in order of their importance were 4-8-8, 5-10-5, 5-8-5, 4-12-4, 4-8-12, 4-8-5, and 3-12-6. More than 10,000 tons of each of the above grades were sold. Of these grades all but two were recommended by the New York State College of Agriculture.

¶ The Inspection and Regulatory Service, College Park, Maryland, has recently issued its annual release on "Maryland Fertilizer Facts for 1940." According to this release, total sales in Maryland amounted to 160,315 tons, of which 121,089 tons were complete fertilizers, 11,378 tons superphosphate and potash mixtures, 7,153 tons nitrogen salts, 11,545 tons superphosphate, and 642 tons potash salts. It is estimated that there were 3,947 tons of nitrogen in mixed fertilizers sold, 12,893 tons of phosphoric acid, and 9,296 tons of potash. The leading grades in Maryland in order of their importance were 2-12-6, 2-9-5, 6-6-5, 2-8-10, 3-12-6, 0-20-0, 4-8-8, and 4-8-12. Fertilizer analyses recommended by the Maryland Agricultural Experiment Station comprised 78,520 tons of the total sales.

Mixtures prepared for use as tobacco fertilizers amounted to 10,986 tons. The total sales of fertilizers in Maryland were slightly less than in 1939, and the plant food contained in mixed fertilizers was lower. In 1939, 164,585 tons were sold, and it was estimated that 4,508 tons of nitrogen, 14,143 tons phosphoric acid, and 10,107 tons potash were contained in mixed fertilizers.

¶ According to the mimeographed report compiled by the Soils Department, Michigan State College, "The Tonnage of Different Grades of Fertilizers Sold in Michigan, 1940," total sales amounted to 166,564 tons. Approximately 72% was sold in the spring and 28% in the fall. The compilation is made possible through reports submitted to the Soils Department by the fertilizer companies doing business in Michigan. The total tonnage of mixed fertilizers amounted to 149,124 tons. Nearly 92% of the sales consisted of grades recommended by the Soils Department. About 96%

of total sales of mixed goods contained 20 or more units of plant food. Comparable figures for previous years are as follows: 1939—93%, 1938—89%, 1937—86%, 1936—81%, 1935—78%, and 1934—73%. This shows a very definite trend toward the use of grades of mixed fertilizers containing higher ratios of plant food. Sales in 1940 were 21,753 tons, or 15% greater than in 1939. The best sellers in order of their importance were 2-12-6, 0-20-0, 2-16-8, 2-8-16, 3-12-12, 4-16-4, 0-20-20, 2-12-2, 0-8-24, and 0-14-6. Superphosphate materials, 2-12-2, and 5-10-5, decreased in per cent of total sales in 1940, whereas 2-12-6, 2-16-8, 2-8-16, 3-12-12, 4-16-4, 0-20-20, 0-8-24, and 0-14-6 increased. The 5-10-5 was dropped from the list of the 10 best sellers in 1940 and 0-20-20 was added.

"Arizona's Agricultural Population," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 88, Dec. 15, 1940, E. D. Tetreau.

"Citrus Management Studies for 1939," Agr. Ext. Serv., Berkeley, Calif., Arthur Shultis.

"Account Sales for Farmers," Agr. Ext. Serv., Honolulu, Hawaii, Cir. 99, Jan. 1941.

"Range of Adaptation of Certain Varieties of Vegetable-type Soybeans," Agr. Exp. Sta., Urbana, Ill., Bul. 471, Dec. 1940, J. W. Lloyd.

"The Kansas Agricultural Outlook for 1941," Agr. Ext. Serv., Manhattan, Kans., Ext. Cir. 146, Nov. 1940.

"Report of Analysis of Commercial Fertilizers, Season 1939-1940," Dept. of Agr. and Imm., Baton Rouge, La.

"Commercial Fertilizers, Feeds, and Agricultural Liming Materials," St. Inspec. Serv., College Park, Md., Control Series, Jan. 1941, No. 177.

"Planning the Physical Layout of Farms," Agr. Exp. Sta., University Farm, St. Paul, Minn., Bul. 350, June 1940, O. W. Howe.

"Eleventh Annual Report of the New Mexico Feed and Fertilizer Control Office for Year Ending Dec. 31, 1940," N. Mex. Feed and Fert. Control Office, State College, N. Mex., Feb. 1, 1941, R. W. Ludwick and Lewis T. Elliott.

"Article 10 of the Agriculture and Markets Law Relating to Sale and Analysis of Commercial Fertilizers, 1940," Dept. of Agr. and Mkts., Albany, N. Y., Cir. 597.

"North Carolina Agricultural Statistics, 1937-1938-1939-1940," N. C. Crop Rpt. Serv., Raleigh, N. C., Dec. 1940, No. 80.

"The Agricultural Outlook, 1941," Agr. Ext. Serv., Clemson, S. C., Cir. 188, Dec. 1940, O. M. Clark and E. H. Rawl.

"Planning the Farm Layout and Cropping System," Agr. Ext. Serv., Knoxville, Tenn., Pub. 245, Nov. 1940, H. C. Holmes.

"Yields of Barley Varieties in the United States and Canada, 1932-36," U. S. D. A., Washington, D. C., Tech. Bul. 735, Dec. 1940, G. A. Wiebe, P. R. Cowan, and Lucille Reinbach-Welch.

"Cotton-price Relationships and Outlets for American Cotton," U. S. D. A., Washington, D. C., Tech. Bul. 755, Jan. 1941, L. D. Howell.

"Seasonal Distribution of Rainfall in Relation to Yield of Winter Wheat," U. S. D. A., Washington, D. C., Tech. Bul. 761, Jan. 1941, J. E. Pallesen and H. H. Laude.

"Handbooks, 1941 Agricultural Conservation Program," U. S. D. A., Washington, D. C., SRB-501, Arkansas A Area, Florida, Georgia, Oklahoma, and Texas.

"1941 Agricultural Conservation Programs," U. S. D. A., Washington, D. C., ECR-501, Maryland and Delaware, Kentucky, Tennessee, Virginia, West Virginia, and ERC-501, North Carolina.

"1941 Agricultural Conservation Programs," U. S. D. A., Washington., D. C., NCR-501, Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin.

"1941 Agricultural Conservation Program Bulletin," U. S. D. A., Washington, D. C., ACP-1941, Dec. 9, 1940.

"The 1941 Agricultural Conservation Program for your Farm," U. S. D. A., Washington, D. C., NER-514 and 515, Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and NER-510, Vermont.

"The Farmer Starts Back," U. S. D. A., Washington, D. C., SRM-505.

"Operation of the Experimental Agricultural Conservation Program in Boone County, Indiana," U. S. D. A., Washington, D. C., Nov. 1940, Harold F. Breimyer and Berryman R. Hurt.

"Cooperative Purchasing of Farm Supplies in Georgia," U. S. D. A., Washington, D. C., Cir. C-120, June 1940, Gerald M. Francis.

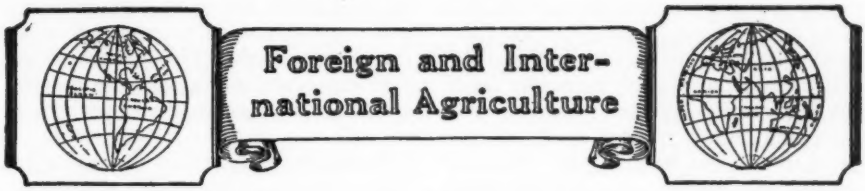
"Report of Federal Surplus Commodities Corporation for the Fiscal Year 1940," U. S. D. A., Washington, D. C.

"Cotton Acreage, Yield, and Production, 1866-1938, By States," U. S. D. A., Washington, D. C., Sept. 1940.

"Cotton, Selected Statistics Relating to Latin America and the United States, 1923-1940," U. S. D. A., Washington, D. C., Jan. 1941, Caroline G. Gries, Dorothy M. Ellis, and P. K. Norris.

"Commercial Truck Crops for Market," U. S. D. A., Washington, D. C., Dec. 1940.

"Corn, Estimated Planted Acreage, Yield, and Production, 1928-1939," U. S. D. A., Washington, D. C., Indiana, Dec. 1940, and Iowa, Nov. 1940.



To supply information on agricultural research and practice in other countries, brief abstracts of articles in foreign publications are given here. Due to space limitations, only articles of general fundamental interest are included, although the publications may contain other articles and reviews.

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INVESTIGATIONS ON THE LOSS OF POTASH FERTILIZERS FROM THE SOIL BY LEACHING. *By v. Nostitz, München, Germany.*

In order to study the movement of potash through a soil, tubes about 20 inches long and 1.5 inches in diameter were filled four-fifths full of soil. A sieve at the bottom of the tube permitted water to drain away, and also permitted the moistening of the soil by means of capillarity. Potash salts at the desired rate of application were added in solution, and then varying volumes of water added to the top of the soil and allowed to seep through. The distribution of the potash was studied by carefully removing the soil from the tube and determining the potash content of the various sections of soil. Owing to the relatively small volume of soil employed, the potash content was determined by the Aspergillus method of Niklas.

In the first experiment, a sandy soil with 2% organic matter was placed in eight tubes and a potash application equivalent to 215 pounds of muriate of potash per acre was given to four of them, the other four being unfertilized to serve as checks. Water in amounts of 100, 200, 300, and 400 cc., equivalent to 3, 6, 9, and 12.5 inches of rain, was allowed to seep through one fertilized and one unfertilized tube for each amount of water. The soils were then removed from the tubes and carefully divided into three sections designated top, middle, and bottom. The determination of the available potash in these layers of soil showed that the added potash had been held in the upper four inches of soil, even with the heaviest water application.

In another trial with a sandy soil of a higher natural available potash content, to which was added muriate of potash equivalent to 645 pounds per acre, similar results were obtained. The use of sulphate of potash, to supply the same amount of potash as the high rate of muriate of potash, showed that there was no difference in absorption by the soil of potash from the two forms.

Soil in eight tubes was treated with the high rate of muriate of potash; half the tubes were leached with 400 cc. of water as rapidly as possible, and the other four with the same amount of water applied in small quantities over a period of four weeks. One tube with each treatment was then further leached. The amounts of water were varied as in the previous experiments, and the available potash in the soils was determined. The data showed that the time over which the water was applied had no influence on leaching of the potash in the soil. Similar experiments with good and poor field soils from various locations all showed that the potash was held in the surface.

A loamy sand and a sandy loam were placed in tubes only 4 inches long, treated as above with muriate of potash at the rate of 215 pounds per acre, and leached with 300 and 750 cc. of water, equivalent to 9 and 23.5 inches of rain, which were the amounts needed to remove all water-soluble material. The results showed that the potash was held mostly in the first inch of soil, with

some going through to the second inch, and a little going through to the third and fourth inches in the loamy sand, but not in the case of the sandy loam. When this was repeated, using 10 times as much potash, or over a ton per acre of muriate, and leached with 500 cc. of water, the potash was washed down through all layers of soil. The absorbing capacity of the soils had been saturated with potash, and therefore large amounts could be leached through.

In order to check on the absorption of potash as measured by the Aspergillus method, soils were treated with heavy potash applications, water leached through, and then the upper, middle, and lower portions were separated and used as media in which to grow barley seedlings in a manner similar to the Neubauer method. Soils without potash applications, but otherwise similarly treated, served as checks. The upper portion of the fertilized soil produced a greater growth of barley than the similar layer of unfertilized soil, while the middle and lower layers of both fertilized and unfertilized soils produced about the same growth. This confirmed the previous experiments, showing that the potash is absorbed by the upper part of the soil.

Realizing these results did not agree with a rather common idea that potash will leach from the soil in relatively large amounts, the author compiled data from other investigators who had studied leaching of potash from soils by means of lysimeters. He shows that with one exception the amount of potash lost by leaching over an 11-year period was small compared to the total potash in the soil.

Based on his experiments, the author recommends that potash fertilizers be worked deeply into the soil. A top-dressing with potash should be harrowed in if possible, or else the rate of application should be high enough to saturate the absorbing capacity of the upper layer of soil and permit some to leach down into the root zone.

Some Experiences With Fertilizer

(*From page* 11)

an immense field ahead for the sale of fertilizers just waiting to be opened up. Consequently, it seemed advisable to get in on the ground floor by securing an agency without further delay.

I put in an application with the Pacific Bone Coal and Fertilizer Company from whom I had already purchased fertilizers for my own use. On securing this agency, I immediately started out to see what could be done in booking orders. In the meantime the company had gotten out a booklet listing the fertilizer materials they had for sale, among which were included special mixtures containing nitrogen and phosphoric acid, but no potash. The reason why these mixtures contained no potash was explained in a paragraph to the effect that California soils contained potash in great abundance and, therefore, it would be folly to apply it to any crop grown thereon. However, they went on to say that should anyone desire to use it, they would gladly include potash in their mixtures.

This statement was so contrary to the results I had obtained when putting the question to the plant, that I immediately went into action by sending without comment one of these booklets to the late Mr. George Meyer of Meyer, Wilson & Company for his reaction. Backed by the success I had met with in the use of potash, Mr. Meyer brought the matter to the attention of the Pacific Bone Coal and Fertilizer Company. They responded without delay by having this paragraph blocked out in all their booklets, and added three formulas contain-

ing potash to their lists, namely, 3-10-5, 3-8-10, and 0-10-10. It is safe to say that the 3-8-10 was the forerunner of the 4-10-10, which is still a strong favorite on the Pacific Coast. The 0-10-10 is still much used where the addition of nitrogen is not needed. The 3-10-5 met with favor for use on grain or wherever phosphorus seemed to be the chief requisite.

Considerably less, however, of the 3-10-5 was sold than either one of the two containing 10% potash, especially to fruit growers who, when their attention was called to the fact that far more potash is taken up by fruits than phosphoric acid, would consider with favor the formulas containing the larger amount. Particularly was this true when evidence of potash deficiencies could be found in their orchards, as indicated by the trees themselves or by the quality of the fruit produced. Another point that invariably went over was that where a certain amount of potash per acre would be required to be effective, it would be necessary to use two times as much of the 3-10-5 as of the 3-8-10 or the 0-10-10. That these two formulas gave satisfaction was amply proved by repeat orders received, as well as orders from new customers who had noted or heard of the improvement taking place in some neighboring orchard from the fertilizers applied.

Potash Alone Ordered

Repeat orders often resulted in orders for potash alone, since in some cases fruit growers figured that potash was the ingredient chiefly needed and the one most heavily drawn upon; that phosphoric acid was being taken up by the trees in far less quantities; and that a good cover crop supplied considerable nitrogen. The use of enough potash annually to meet full requirements, supplementing it by the addition of phosphoric acid applied every second or third year, and the growing of cover crops proved to be a sound and economical practice in many cases. Health and vigor of trees were maintained, production increased, and quality of fruit improved. Another economical and successful practice that met with favor was to apply the 3-8-10 at the rate of about 500 pounds per acre on one-half of the orchard, and from 100 to 200 pounds of potash alone on the other. The next year the process would be reversed, the potash alone going where the 3-8-10 had been applied the year before and the 3-8-10 following the potash-alone treatment.

Fruit Quality Improved

It was found in some orchards, where potash deficiencies were indicated, that applications of potash alone met all requirements. One prune and apricot grower, whose orchard was on a deep, slightly gravelly loam, applied only potash on part of his apricots and prunes. The application to the apricots was not made until after the crop was thinned and all danger from frost injury was past. It was then applied and followed by an irrigation. Forty days later he was harvesting his crop, all of which was sun-dried. On calling on him, while the fruit was still on the trays, he took me out to his drying ground and showed me the great difference in the quality of the fruit from where the potash had been applied, as compared with that from the trees which had received none.

The fruit then was about dry and ready to be taken up. That from the potash-treated trees was heavy and thick in texture, indicating a low shrinkage in drying. It was perfect in color, rich and tempting in appearance. In the trays alongside, fruit from the trees receiving no potash was thin and light in weight, indicating low sugar content and heavy shrinkage. It lacked the rich, appetizing appearance of the fruit from the potash-treated trees. Later in the season, after his prunes were harvested, he reported that the improvement in the prunes from the use of potash was just as marked as in his apricots. Fully 25 years later this same fruit grower told me that potash was not only the best, but the only fertilizer that had given any noticeable results on his place.

Available Potassium In Alabama Soils

(*From page* 8)

TABLE 3. THE TOTAL POTASSIUM, REPLACEABLE POTASSIUM IN THE SOIL BEFORE AND AFTER CROPPING, AND THE AMOUNT OF POTASSIUM REMOVED BY FOUR CROPS (SOYBEANS, VETCH, PEANUTS, AND COTTON) GROWN ON 10 DIFFERENT SOILS IN THE GREENHOUSE IN ONE YEAR

Soils	Pounds per acre						Percentage of K used by four crops which came from non-replaceable forms	Percentage of K available to four crops which was non-replaceable at the start of cropping	Percentage reduction in replaceable K in the soils due to removing four crops
	Total K in the soil	Replaceable K in the soil before cropping	Replaceable K in the soil after growing four crops	K removed by four crops	K removed by four crops plus that remaining in the soil in replaceable form	K supplied from non-replaceable forms in the soil			
Tifton sandy loam	1,182	42	24	79	103	60	76	41	43
Orangeburg sandy loam	1,454	39	18	74	92	53	72	42	54
Colbert fine sandy loam	3,818	51	36	91	127	76	84	40	29
Cecil clay	5,545	43	45	92	137	94	102	31	0
Clarksville sandy clay loam	6,181	93	61	136	197	104	76	47	34
Savannah very fine sandy loam	6,545	71	39	115	154	83	72	46	45
Hartsells very fine sandy loam	6,636	91	45	127	172	101	80	53	51
Durham fine sandy loam	7,070	55	27	113	140	85	75	39	51
Decatur clay	10,817	175	121	230	351	176	77	50	31
Davidson clay loam	12,817	141	52	180	232	91	52	61	63
Average	6,207	80	47	124	171	92	77	45	40

what appears to be a normal fifth crop, while others are growing plants showing extreme potash starvation. The amount of potassium removed by the crops has been determined. In addition, the soils were analyzed at the start of the experiment for total and replaceable potassium, and again after the fourth crop for replaceable potassium. The results of these analyses show conclusively that the plants were able to remove much more potassium from these 10 soils in one season than was contained in the soils in an exchangeable form at the start of the experiment. Roughly 75% of the potassium removed from the 10 soils in one year came from the non-exchangeable form. In one case, that of Cecil clay, all the potassium removed by the plants came from non-exchangeable forms and in another case, that of Davidson clay loams, only 52% did; all the other soils fell between these two limits. Further comparisons can be made by studying Table 3. The variations between the ability of the soils to release non-exchangeable potassium are dependent on the kind and amount of potassium-bearing minerals they contain. The kind of potassium-bearing minerals is quite important as revealed by the fact that Cecil clay containing only 5,545 pounds of total potassium per acre supplied just as much non-replaceable potassium to plants as did Davidson clay loam which contained 12,817 pounds.

It is commonly believed that soluble potassium applied to soils does not leach. Most investigations on this problem have been done with soils containing a reasonable supply of exchange materjal. Here, again, the agencies of weathering were severe on Alabama soils in the majority of cases. Our soils have been weathered to such an extent that great areas of the sandy soils have total exchange capacities of only three m.e. or less. Thus, the capacity of our soils for holding soluble potassium is very low in a great many cases and, as a consequence, a portion of the applied potassium will be leached below the feeding zone of the plants by the first big rain. The fact that leaching does take place is shown in Table 4.

The leaching of potassium can be prevented in the South to some extent through the use of winter legumes, most all of which feed heavily on potas-

TABLE 4. THE AMOUNTS OF POTASSIUM LEACHED BELOW THE FEEDING ZONE OF PLANTS IN SOME ALABAMA SOILS

Soil	Total amount of potassium applied in 8 years Pounds per acre	Amount of potassium that leached into and was retained by the 8 to 24-inch depth* Pounds per acre
Norfolk fine sandy loam	80	7
	160	40
	320	92
	640	216
Hartsells very fine sandy loam	80	9
	160	30
	320	64
	640	200
Decatur clay	80	0
	160	9
	320	23
	640	56

* Some potassium undoubtedly leached below the 24-inch depth in many cases but the amount was not determined.

sium. Eight years' results on eight Alabama soils showed that an average of 20% of the potassium applied was lost through leaching when no winter legumes were grown, and only 3% was lost when winter legumes were grown. Thus, aside from supplying nitrogen and organic matter to soils, winter legumes conserve soil potassium for future crops.

was planted. One plot receiving 24 pounds of potash produced 652 pounds of seed cotton, while another plot (similarly treated throughout) receiving 72 pounds of potash produced 1,075 pounds of seed cotton.

The fact that harvested peanuts deplete the soil of potash is further emphasized by a study of the results of plot tests presented in Table 5. In

TABLE 5. THE EFFECT OF HARVESTING PEANUTS ON THE SUPPLY OF AVAILABLE POTASH IN SOILS AS COMPARED WITH OTHER CROPPING SYSTEMS

Crop	Fertilizer	Pounds of replaceable potash per acre after last crop was harvested
8 crops of peanuts—hogged off	0	106
6 crops of cotton	0	58
8 crops of corn	0	54
8 crops of peanuts—harvested	0	30
3 crops of peanuts—hogged off, 3 crops of corn, 2 crops of cotton	6–8–4 to cotton	54
3 crops of peanuts—harvested, 3 crops of corn, 2 crops of cotton	6–8–4 to cotton	32
4 crops of cotton, 4 crops of corn	6–8–4 to cotton	100
2 crops of cotton, 3 crops of corn, 3 crops of peanuts—harvested	6–8–4 to cotton	32

It has long been known that continually digging peanuts and removing both the vines and nuts from the soil will reduce the yields of crops that follow to an alarming extent. On the Wiregrass Substation, peanuts harvested for 7 years reduced the yield of seed cotton the eighth year about 900 pounds per acre as compared to continuous cotton. In another test, a 3-year rotation of corn, cotton, and peanuts (harvested) was grown. No fertilizer was applied to the corn or the peanuts, but a 6-8-4 was applied to the first two crops of cotton. After three crops of corn and two crops each of cotton and peanuts were grown, a final crop of cotton every case where peanuts were harvested, the supply of available potash was reduced to about 30 pounds per acre.

During the fall of 1939 a search of the State was made for adjacent fields, one of which had grown peanuts (harvested) for at least two out of the past five years, and one which had had no peanuts grown on it for five years. A total of 44 fields were located and the soil sampled. In every case the field from which peanuts had been harvested was lower in available potash than the adjacent field. The 22 fields from which peanuts were harvested contained an average of 36 pounds of replaceable

potash per acre, and the adjacent 22 fields on which peanuts were not planted contained 87 pounds of replaceable potash per acre.

A careful study of the results obtained on 283 cooperative tests conducted by J. T. Williamson of this Station reveals that certain regions in Alabama respond more readily than others to more than 25 pounds of potash. For example, about 55% of the Norfolk and Clarksville groups will respond to extra potash as compared to about 25% of the Decatur and Orangeburg groups (Table 6). It would be of great value to the farmers of the State if a quick method were available for determining which of their fields would respond to extra potash.

Replaceable or available potassium, as it is sometimes called, has reached as low a level in Alabama soils as will probably be found in any state in the Union. About 30% of all Alabama soils contain less than 60 pounds of replaceable potassium per acre, about 60% contain less than 100 pounds, and only about 10% contain over 200 pounds. These meager amounts exist even in face of the fact that farmers apply roughly 33 million pounds of potassium to Alabama soils annually, about 70% of which goes to 2 million acres of cotton, or about 12 pounds per acre per year.

Practically all Alabama soils respond to 25 pounds of potash, and a great many respond to more than 25 pounds when cotton is the crop grown. (Cooperative tests indicate that about 40% of Alabama soils need more than 25 pounds of potash—600 pounds of a fertilizer containing 4% potash.)

Many investigators have attempted to devise chemical methods of measuring the needs of a soil for potash. These have been thoroughly tested in Alabama, and the results from 486 experimental plots scattered over the entire State indicate that even when using the best quantitative laboratory methods available (not field kits or quick tests), only 65% of our predictions will prove to be valid and 35% will prove to be

TABLE 6. THE DISTRIBUTION OF 283 COOPERATIVE FIELD TESTS ACCORDING TO SOIL SERIES GROUPS AND THE RESPONSE TO MORE THAN 25 POUNDS OF ADDED POTASH

Soil series groups*	Total number of field tests	Average amount of replaceable potash in the soils in pounds per acre	Percentage of tests that responded to more than 25 lb. of added potash per acre	Average increase in pounds of seed cotton per acre for the tests showing a response to more than 25 lb. of potash added per acre
Norfolk	93	74	57	76
Clarksville	29	137	55	94
Hartsells	28	110	36	157
Cecil	28	111	32	53
Decatur	67	231	30	78
Orangeburg	38	142	24	67

* Norfolk group contains Norfolk, Ruston, and Kalmia. Clarksville group contains Clarksville, Colbert, and Susquehanna. Hartsells group contains Hartsells and Hanceville. Cecil group contains Cecil, Durham, Louisa, and Appling. Decatur group contains Decatur, Dewey, and Holston. Orangeburg group contains Orangeburg, Red Bay, Greenville, Cahaba, and Amite.

incorrect when we attempt to determine which soils will respond to more than 25 pounds of potash. (Soil series and soil texture were considered in all cases.)

In determining whether more than a given amount of some certain fertilizer or fertilizer element is needed to produce maximum net returns, one must always bear in mind that averages will likely give an erroneous picture of the actual situation. A much more reliable method is that of determining the percentage of soils which respond to this or that treatment. This is true because it is a well-known fact that an excess of most any element will cause a decreased yield, and potassium is not an exception. Averages tend to minimize important differences.

The differences in cotton yields on plots containing identical amounts of replaceable potash are due, very likely, to several factors, the most important of which are: (1) variations in previous cultural practices, (2) variations in the organic matter content of the soil, (3) variations in the compactness of the immediate subsoil layer, (4) the kind of crop grown the previous year, and (5) the fact that so-called replaceable potassium is not the only form of potassium that is available to plants.

Most any casual observer in the South has noticed very uneven growth of crops on a given field. In one portion of the field the cotton will be 3 feet high, and not 50 feet away it will be only 18 inches high. Why? Certainly it is not the lack of ordinary plant-food elements, because in most cases a uniform application had been applied to the entire field. It is believed that one or more of the difficultly measurable factors mentioned above is the cause for the variations found in such fields. All in all, these many unmeasurable or difficultly measurable factors which occur in the highly depleted soils of the South have such a profound effect on the crops grown, that the amount of replaceable potassium contained in the soil is apparently insignificant as a measuring stick for determining the needs of a soil for potassium in approximately 35% of the fields. Substation, experiment field, cooperative, and even independent tests by the farmers themselves appear to be the real means by which the fertilizer needs of any given soil can be determined with any degree of accuracy.

The Champlain Valley Improves Its Apples

(*From page* 20)

mulch. Some growers find it economical to obtain mulching material by bringing in spoiled hay or using barnyard manure from their dairies. Nearly all find it expedient to grow grass and other permanent cover crops in their orchards. Some find it feasible to grow much of their mulching material among the trees in the younger blocks. This brings up the problem of increasing the yield of such cover crops, which is sometimes done by top-dressing with manure or nitrogen. In some orchards, new seedings are made occasionally, including some kinds of clover or alfalfa. With these, the need of phosphorus is well established and potash may be desirable on some of the soils. This requires further testing. Although some soils are neutral or slightly alkaline, others require lime for best growth of legumes.

In many orchards, boron is needed about once in three years for the prevention of internal cork and other boron-deficiency symptoms of apples. There are indications that boron may also benefit alfalfa which might assume a more important role as a cover crop if stands did not die out so rapidly, although alfalfa sometimes accentuates the buffalo tree-hopper insect problem.

Potassium has been found beneficial to apple trees exhibiting a certain characteristic type of leaf-scorch. Such scorch is at present largely limited to a fairly small number of young orchards. Potassium-deficiency symptoms are not identical in all apple varieties. However, it is sometimes possible to separate

White spotting of alfalfa and clover leaves such as occurred in orchard where apple trees responded to potash.

the more common types of leaf-scorch by their symptoms.

Further assistance may ultimately be available from leaf analyses, if an objective of the Pomology Department at Cornell is attained. This is to establish the range in potassium content within which trees behave normally, and the point below which potash may be beneficial. At present, however, leaf analysis is of use chiefly in supplementing field tests. Some trees in the Champlain Valley show a rather low potassium content even though actual leaf-scorch is not present. Whether these trees might respond to potassium is an open question. Preliminary experiments have shown that no striking response is obtained, but sand-culture tests by other investigators have shown that a growth response from potassium is possible even in the absence of leaf-scorch. Leaf analysis seems a more promising approach than soil analysis, since no method of soil analysis indicates accurately how much potassium the tree will be able to obtain from the soil. In experiments to date, striking improvement in fruit color was obtained *only* in trees where leaf-scorch was overcome.

More work is needed on the possible effect of potassium on color where the leaf content of potassium is low but no scorch is present. The major factors influencing fruit color seem to be the weather, the carbohydrate supply, and the nitrogen content of the tissues shortly before harvest, a low nitrogen content being conducive to high color. The possible direct and indirect roles of potassium deserve further study. It seems possible that maximum growth of certain cover crops may require the use of potash. It is almost universally accepted by horticulturists and fruit growers that a liberal supply of organic matter should be grown in the orchard or imported.

While supplying the right amount of nitrogen in a suitable form continues to be the major fertilizing problem of the Champlain Valley apple grower, recent experiments indicate that this is not the whole problem. Boron is needed for direct tree use in most orchards, and a case of direct tree benefit from potassium has been established. Studies on the possible need of the trees and cover crops for various elements, now in progress in the region by different groups, may conceivably lead to modification of fertilizer recommendations. Mulching with hay or manure seems a widely applicable method of alleviating nutritional difficulties whether or not their precise nature is understood. However, in common with other practices that cause a high nitrogen content in the apple leaves late in the season, mulching sometimes increases trouble with fruit color and dropping.

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The Nutrition of Muck Crops

(*From page* 16)

peared on untreated fields, have been found in our studies to be very effective in checking the disease and preventing a complete loss of the crop.

Boron-deficiency disease of sugar beets has been reported by numerous investigators as occurring occasionally on mineral soils. It also has sometimes appeared on certain muck soils, both alkaline and acid in reaction. The disease appears as a stunting and curling of the petioles (leaf-stems), especially of those of the later leaves developing during warm weather, sometimes accompanied by a chlorotic yellowing of the older leaves and a rotting of the roots. Girdle or canker of table beets occurs as a cracking of the outer skin of the root near the soil surface, followed by a decaying as shown in Fig. 9. It frequently occurs on alkaline mucks, and has been controlled in our investigations with a 100-pound-per-acre application of borax on alkaline mucks and with 25 pounds on acid mucks.

Row Fertilization. Studies regarding the proper placement of fertilizer for Michigan muck crops have been continued since 1925. The results have been consistent in showing that best results will be secured with row fertilization of such crops as onions, celery, and beets on high-limed mucks which are well supplied with moisture, but that the broadcast method will give better results on mucks which are inclined to be droughty or which are strongly acid. A broadcast application, drilled about three inches deep, generally gives better yields than one spread on the surface and disked in. With ample moisture supply, an application of the fertilizer in the row about two inches directly below the seed is almost certain to give better yields of onions, potatoes and beets than an application at one or both sides of the row. Row fertilization is not advisable for beans or for members of the cabbage family when sown in the field.

For transplanted crops of celery or cabbage, row fertilization at a depth of about three inches below the surface should be made at least one week before the crop is transplanted, in order to prevent injury to the roots of the transplants. When the muck is well supplied with moisture, most of the nitrogen and part of the phosphate-potash mixture, for such crops as celery and cauliflower, may be applied as a side-dressing during growth. Not more than 25 pounds per acre of copper sulphate or borax should be applied in the fertilizer used in a row application, but, on alkaline muck, 100 pounds per acre of manganese sulphate, mixed in the fertilizer, can be safely applied in the row.

Fig. 10. Soybean leaves from College muck plots, showing potash deficiency on left and manganese deficiency on right, with normal leaves between.

Fig. 11. Only a few years ago a dense swamp, this productive muck is yielding a nice crop of celery of excellent quality.

Discussion. Satisfactory returns from the use of fertilizer on muck land depend not alone on the selection of the proper fertilizing materials. Fertilizers can not overcome the disastrous effects of poor drainage or of excessive drought. The muck farmer most likely to secure optimum returns from his fertilizer investment is the one who has such good control of the water level in his muck soil that he is practically independent of the weatherman. He must plant seed of high germination, of a variety satisfactory for muck,

TABLE 7.—SHOWING INCREASES IN YIELD OF A REPRESENTATIVE CROP (SUGAR BEETS) RESULTING FROM THE USE OF SALT ALONG WITH A HIGH-POTASH FERTILIZER MIXTURE. COLLEGE MUCK, EAST LANSING

Plot No.	Annual application per acre, 1932–'39		Representative increase over 0–8–24		Crops benefited by salt application on muck
	Fertilizer analysis 600 lbs. ('32–'37). 900 lbs. ('38–'39)	Salt Lbs.	Sugar beets Av. 8 years Tons per acre		
			Roots	Tops	
(Control plots 1, 6, 11)	0–8–24	0	...	...	Sugar beets, table beets, mangels, Swiss chard, celery, celeriac, turnips, cabbage, Kohlrabi, kale, radishes, and rape
2	0–8–12	500	2.7	4.9	
3	0–8–24	500	4.3	5.5	
4	0–8–48	0	3.5	3.3	
5	0–8–24	1000	5.0	6.4	
12	0–8–0	500	−3.4	−0.5	

as well as to the consuming public; he must protect the growing crops from disease and insect injury and finally offer it on the market in an attractive condition.

From the preceding discussion it is evident that, within fairly recent years, the proper fertilization of muck soil has become a very complex operation. First of all, the muck should be tested to determine whether or not it may require lime, or may possibly contain an excess of lime and be alkaline in reaction. The proper fertilizer mixture for the soil and the crop should be determined (See Table 3). To this should be added copper or manganese sulphate, borax and salt, if the reaction of the soil and the nature of the crop (See Table 5 and footnotes to Table 3) indicate they will be needed. This requires careful study and sometimes trials in the field with the different constituents to see what results will be secured on a particular muck, but, in the end, such studies are well worth while. The muck farmer, who would be successful, must be a student in his work, keeping his mind open to new advances in the fertilization of his soil, yet using good judgment in the application of those discoveries to his particular crops and conditions.

Keeping Celery High in Quality

(*From page* 22)

sult, his crop is as free of blight as it is possible to make it, and it is absolutely uninjured by insects. The usual practice is to spray weekly with a 4-4-50 mixture of freshly mixed bordeaux, applied with a high-pressure sprayer. Between spray applications, sometimes as often as once a week, the plants are dusted with a mixture of 44 pounds hydrated lime, 44 pounds superfine sulfur, and 12 pounds monohydrated copper sulfate for the control of tarnished plant bugs. Application of this powder is not made regularly, but is dependent upon the threat of danger.

There's nothing strange or uncanny about the method used by Haug in keeping diseases and insects under control. He merely follows the standard practices which the scientists at the Pennsylvania State College have found most satisfactory for his conditions, and which the State agricultural extension specialists would like to see all growers use. He merely follows the pattern religiously.

The first marketable celery is grown for the market in hotbeds, with the first plants going to the field about May 10. Marketing usually begins about the latter part of June and continues until Christmas. Most of the crop is sold on the local Williamsport market where Haug has a stall at the farmers' market which is open for business every Wednesday and Saturday. By this time, buyers are well acquainted with the quality of the Haug celery, and so he bumps up against little difficulty disposing of his crop at reasonably profitable prices.

Irrigation Important

Another thing that insures quality in the crop is that it is irrigated regularly when nature fails to supply sufficient moisture. A semi-Diesel motor pumping water from a well at the rate of 300 gallons per minute supplies all the water needed to quench the thirst of the 18 acres of water-hungry celery. The entire truck farm is equipped with an overhead sprinkling system that makes watering the crop merely a job

of starting the motor and turning a few valves.

Even though the waters of the Susquehanna are so near at hand, Haug is careful to use well water for irrigating his crop. "It's as good as anyone would want to drink. We wouldn't think of using anything else," he claimed emphatically.

Paper cuffs are used for bleaching the crop. Depending on the weather, these are placed around the plants 2 or 3 weeks before the time of harvest. That gives the plants a chance to take on the desirable color that pleases customers.

The remaining 7 acres of the Haug truck farm are planted to any other crops that can be grown in central Pennsylvania. These include spinach, carrots, cabbage, peas, beans, and many others, but all receive the careful attention with which the celery crop is handled.

In general, it might be said that Haug's secret of success is the maintenance of extremely high soil fertility and the strict attention to the most minute details from the time the seed is obtained until the marketable products are in the hands of the customers.

Shares Well Scoured

(*From page* 5)

crankcase, but the very fact that you've refilled it means you ought to go somewhere else. Another hang-out gone!

One used to find solace at times gabbing with the country lawyer, especially before the fall term began and some juicy anecdotes were ripe. But just try to fool away precious moments with a brace of these trained seals in separate glass cages, guarded in the front office by a little snip with an "Information" sign on her desk. No, these young squirts can't equal the old squire, and one more bet is lost.

OR search in vain with me for the weazened but wise old cobbler, that builder of brogans who told many tales while tapping, and who usually had room for a couple of cronies amid the leather and findings of his cluttered nook. Instead, today we have a row of whirring machines and a labor union boss standing guard.

So we turn back with the would-be retirer to seek what we want out in the ozone, and bless me, if we don't find it! There's more leisure and laziness open to the agricultural world than there used to be. Power machinery has come to lighten the long day's toil and bring surcease to stiff backs. Unless you have a big herd to feed or a milk route to handle, the morning hours are not so ungodly early either. One can now do a task in a jiffy that would have taken a night's rest out of a chap in thinking about it when we were young.

THEN besides, the AAA has come along and squashed a lot of endless ambitions to plow up more of the township than one has title to. There's more rested land and more go-down crops and more grass silage, so that weather vagary doesn't run a man ragged so often as of yore. The mailman totes the daily grist right handy to the front porch and the sitting room, and the magazines, newspapers, and radio "broadblasters" make one live the life of Riley. Roads are pretty good all season and there are so many visitors that one begins to call some of them interlopers, especially the farm paper editors. It's got so bad, indeed, that many of my country kinsmen have invested in trailers and spend the winters in Florida, which is the only retiring they stand for now.

Of course there are some codgers who think land values are too durn high to retire anyhow, accepting a doubtful mortgage and leaving the place to fall behind under some youngster's direction. Indeed we realize that the financial side of the picture has checked many older farmers from tossing aside responsibility, with interest to meet and production costs advancing.

As we travel about the countryside we often notice somebody building an extra dwelling, set a bit apart from the old homestead and smaller. These modern shaped houses and their interiors look different from the old upright and wing or square or rectangular houses we knew so well. As a rule this, too, is a sign of permanent partnership, expressing the intention of the father and son to settle down and live forever near the furrows.

But as a matter of reality these days, the *retiring* is not half so dubious and puzzling as the *acquiring*. By this I mean that it is the oncoming generation, despite their advantages in scientific training (and partly because of those higher standards), who find it hard to begin well where Dad left off.

THEIR big problem is to arrange affairs so that financial expansion and upkeep don't outrun the ability of the soil or the size of the farm. That problem is doubly acute in cases where Dad has passed away and left a will which divides the proceeds of the farm among three or four children. The one who sticks to the loam has to hustle to defray the normal expenses, and in addition has the burden of sharing with the others, some of whom are away earning good money in non-farm pursuits. It sort of seems to many of us that it isn't fair for the home lad to be obliged to raise and butcher a calf to feed the prodigals, using an extreme illustration.

So it happens that with this prospect so common there are more "surveys" going on up my way over unsettled and uncertain farm youth crying for deliverance than there are inquiries into the why and wherefore of non-retirement. We look to the soils and the harvests to come rather than the garnered goods of the past. Thus far we just have the survey data tabulated neatly for circulars and talkfests, but we have no decisive program ready to answer it.

MEANWHILE, we are pretty sure as things look now that even in this treasured and sacred zone of family-sized farms we are about to revalue and reconsider the meaning of that hackneyed term. Just as sure as spring is with us, we are going to get larger family-sized farms, not because the birth rate will jump after the war, but because the ability of one or two men to handle a given land area has multiplied many fold. What that means, if power and science and organization keep on making farmers more efficient, is beyond my feeble pen to answer. For the consuming two-thirds it may spell cheaper food, and that is well, provided all the burden of making it cheap doesn't fall on the farmer. In that circumstance, he will want to retire a heap sooner than he does now, and the Lord help the one who takes hold of the plow when he quits!

Temporarily things point to a change in this situation under the stress of compulsory military service, of course. We witness hosts of farm boys turning aside from the spring seeding to the training camps, leaving behind them the elder veterans who must forswear any idea of resting and plunge into the fields for double duty. Hired hands at best are hard to get, so 1941 will not be a popular year for vacations or retirement among the senior planters.

Yet ever since the steel moldboard came into play, the presence of grit in the soil has kept it brightly scoured with constant use. Nothing else in agriculture looks worse than a spotty, rusty plowshare laid aside for the junk heap or the museum.

Action, renewed hopes, and some reward for its owner, betokens the share well scoured. That's my April wish for agriculture and its devoted friends. So not a word more of retirement!

Two English washwomen were discussing the German bombings of the War. One said, "Any night now we may be blown into maternity!" "Yes," said the other, "and with these blackouts we will never know who did it!"

Well—?

"Jack, are you sure it is I you are in love with and not my clothes?"

"Test me, darling!"

Customer: "Remember that cheese you sold me yesterday?"

Grocer: "Yes, madam."

Customer: "Did you say it was imported or deported from Switzerland?"

The other night, it seems, a California constable was getting ready for bed when he thought he heard a noise in the chicken house. He had disrobed clear down to his long underwear, but didn't want to take time to put his clothes on again, so he just slipped on his shoes, grabbed his trusty shotgun and the flashlight, and went out to investigate.

Reaching the hen house he threw open the door and sorta squatted down, pointing the gun and flashlight toward the roosts and peering into the void .... Well, you know the seat construction of long drawers. . . . About that time his old collie dog came to see what was going on, touched the rear of the chicken-raising constable with his cold nose, and he unintentionally killed 14 of his best pullets.

A negro woman was standing on the street watching a circus parade. One of the pickaninnies looked up and said: "Mammy, your mouf's open." To which she replied: "Yas, I knows it. I lef' it open myself."

I shot an arrow into the air,
It fell to earth I know not where;
I lost ten of the damned things that way.

Hitler was interviewing his troops and stopped to talk to one private.

"How are things with you?" he asked.

"Oh, I can't complain, sir," answered the soldier.

"I'll say you can't," agreed the Fuehrer.

BEEN OUT BEFORE

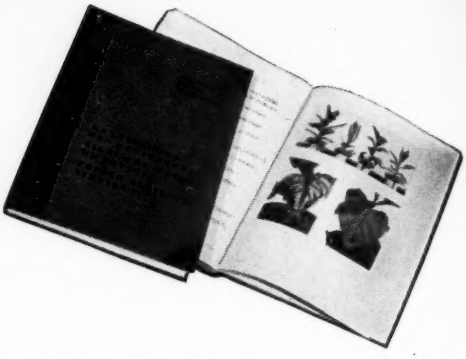
He: "I'll be tickled if we find a filling station soon, the gas is running low."

She: "And I suppose I'll be tickled if we don't!"

Breathes there a man with soul so dead, who never hath turned his head and said, "Hmmm, not bad!"

"If you wish to be happy for an hour, get drunk. If you wish to be happy for three days, get married. If you wish to be happy for eight days, kill your pig and eat it. But if you wish to be happy forever, become a gardener."—Chinese Proverb.

POTASH DEFICIENCY SYMPTOMS



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